GREATER TORONTO AREA

3Rs ANALYSIS

SERVICE TECHNICAL

APPENDIX - SCHEDULES

VOLUME I

FINAL - MAY 1994

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for
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Service Technical Appendix

VOLUME I

SCHEDULE A

POTENTIAL WASTE DIVERSION IMPACTS OF SECONDARY ENHANCEMENT COMPONENTS

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Table 3.3 of the Service Technical Appendix provides an estimate of waste diversion that may be achieved through addition of the short and long term secondary enhancement components to any of the 6 residential or IC&I waste diversion systems. The following provides a brief rationale for the estimates presented in Chapter 2.

1.6 Landfill Ban on Leaf and Yard Wastes to Force Increased Management on Residential Property

Waste composition estimates indicate that 2% to 11% (Halton 2%, Metro 4.6%, York 7.6%, Peel 10.9%, Durham 11%) of residential waste, and 1% of IC&I waste disposed in 1992 was leaf and yard waste. Most of this would be diverted if a leaf and yard waste ban was imposed.

1.7 Eliminate Pick-up for Leaf and Yard Waste

A portion of the 2 to 11% of residential waste which was leaf and yard waste, and was disposed in 1992 could be diverted.

1.8 Increase use of Refillable/Reusable Packaging and Products

Disposable packaging is 25% of residential waste, and an assumed 25% of IC&I waste (Franklin, 1988). Increased use of refillables and reusable packaging should be able to provide every package with at least 10-30 uses (average 20 refills) prior to requiring disposal. Assume at least 20% of current disposable packaging (i.e. 5% of the residential waste stream) can be replaced in this way, and that each refillable/reusable package has 20 journeys/reuses. However, reusable and refillable packaging is often heavier than disposable packaging, (twice the weight was assumed for this analysis). Therefore, when disposed (after 20 refills) the container weight is heavier, for a net reduction in the disposed weight of 90%. Therefore, the portion of the residential waste stream impacted by this change (5%) is reduced by 90%, for an overall reduction of 4.5% of residential waste.

1.9 Landfill Bans on Recyclable Materials

Landfill bans currently exist in GTA on many recyclables generated by IC&I sources. Most of the gains with a blanket landfill ban policy would be made through increased diversion of residential waste.

For this assessment it is assumed that recyclable material includes: ONP, OCC, glass, steel, aluminum, PET, HDPE, LDPE and half of bulky goods. Residential waste composition shows that 25% of the waste stream disposed consists of these materials. It is assumed that a landfill ban would probably divert 70% of the targetted materials, therefore this would result in diversion of 17.5% (25% x .7) of residential waste.

1.10 Waste Reduction Planning Requirements for Construction/Demolition Projects

Waste reduction planning requirements for C&D projects would force C&D companies to consider 3Rs as part of each project. The requirement to specify that recycled content material was used in construction would increase awareness of the availability of these materials, and would be likely to strengthen markets. The benefits of this policy would be felt over the longer term, as awareness of 3Rs options increase among all levels of the industry. A detailed estimate of the potential diversion impacts of this policy cannot be developed in the absence of exact requirements. For this analysis it is considered reasonable to assume that this policy would achieve at least 10% diversion of C&D waste.

1.11 Procurement ordinances (favouring durable products, recycled content and/or reusable purchases)

Governments (including Metro Toronto and the City of Toronto) have implemented schemes that incorporate the use of recyclable and recycled materials, and durable and reusable products (such as price preference for designated recycled or reusable products, specifications that contractors use these products etc.). Two examples include GIPPER, (Governments Incorporating Procurement Policies to Eliminate Refuse) at the provincial and municipal level, and the Peel Region HOW (Help on Waste) program. Procurement ordinances reduce waste and support 3Rs activities by driving markets for recycled products. At this time, exact impacts on local waste streams (such as in the GTA) can not be identified.

1.16 Product redesign for increased product life and durability

The rate of disposal and replacement of existing goods is slowed by extending product life and durability of goods resulting in decreased quantities of durable goods disposed. No studies presenting accurate estimates of quantities or percent weight reduction are currently available. However, several companies are presently engaging in R&D to lengthen the lifespan of the products they create. Durable goods contribute 4 to 8% of the disposed residential waste stream. This could be decreased if product life is lengthened. Assuming that the life of a durable good (such as a toaster) were increased from 5 to 7 years (40% increase), discard rate for this item could decrease by same amount. A minimum 10% increase in product life is not unreasonable to assume. If applied to all durable goods in the waste stream (which would require cooperation of all manufacturers of products sold to Canadian Consumers) the impact would be 0.4 to 0.8% reduction of the residential waste stream.

1.17 Packaging redesign to reduce quantity and weight

Packaging constitutes 25% of residential and an assumed 25% of IC&I waste. Packaging reduction is recommended as a voluntary means of source reduction through NAPP, and is mandated for certain sectors by the Ontario 3Rs regulations.

Packaging redesign involves reviewing current packaging formats and substituting materials that are smaller or of a lighter weight. It incorporates utilization of recycled materials in new packaging formats, to reduce the use of virgin materials. McDonald's Restaurants have also been active in lightweighting packaging wraps. Many other companies have been redesigning packaging and products to incorporate recycled materials, such as Rubbermaid, (using secondary LDPE stretch film for plastic and rubber products) and Proctor & Gamble and Lever Brothers (using recycled boxboard in detergent board boxes) (Faulkner, 1993). Kraft General Foods Canada achieved a 20% reduction with downgauging and lightweighting, but like other companies, will need to incorporate full packaging and packaging concept redesign to achieve further reductions (Faulkner, 1993).

As an example, if improvements through packaging redesign could be applied to 20% of packaging waste (5% of the overall waste stream) and achieve 30% weight reduction, this would result in a net 1.5% diversion increment.

1.19 Deposit/Refund Systems for a Variety of Materials

Deposit/refund systems provide an economic incentive for consumers to return rather than dispose of the materials on which the deposit was paid. Ontario's Brewers Retail is a well known example of a successful deposit-refund system, with reported recovery rates of 94%. Jurisdictions which impose deposits or levies on materials such as lead acid batteries or tires also report high recoveries.

Recoveries of many metal, glass and plastic containers are currently reported at 70-90% (Barrie MORE project, Quinte) through established Blue Box programs. Assuming that a

deposit system would get 90% recovery of all glass, steel, aluminum and plastic food and beverage containers, and that an average of 80% are currently diverted incremental diversion would be 10% (90-80%=10%) of the portion of the waste stream (8-10%) which are food and beverage containers, i.e. a diversion increment of 8-10% x 0.1 = 0.8-1%.

The incremental impact would be 1.6 to 2% in municipalities which currently experience a 70% recovery level.

1.24 Develop Infrastructure for Distribution of High Quality Food from Catering Facilities (e.g. Second Harvest)

Food waste constitutes approximately 7% of IC&I waste. A portion of this could be diverted for human consumption (i.e. through food banks, soup kitchens etc.) or, if this is not viable, for consumption as animal feed. As an example, Second Harvest successfully diverted 450 tonnes of food waste in 1992. The establishment of a central food waste management organization would help develop a network to facilitate direction of food waste by retailers and manufacturers to appropriate end users. The exact incremental diversion that could be attributed to this component would depend on the type of organization established and potential end uses for the product. The impact of this component has not been measured to date. However assuming that 10% of IC&I food waste is of a suitable quality to be redistributed for human consumption, and could be diverted, this results in diversion of 0.7% of the IC&I stream. If IC&I waste is 60% of the total waste stream, this component might divert 0.4% of the total waste stream.

1.28 Provide Neighbourhood Leaf Shredders in Fall

Leaf and yard waste constitutes 2% to 11% of the residential waste stream disposed in GTA in 1992. (Durham 11%, Halton 2%, Metro 4.6%, Peel 10.9%, York 7.6%). Of this total 25% is leaf waste, and 75% is yard waste. Providing leaf shredders would decrease the bulk (and increase the density) of leaf wastes. It would contribute to increased diversion by providing more options for management of leaf waste (home composting, central composting, local use as mulch etc. see Schedule B). Assuming that this measure would help divert half of the remaining leaf waste, the diversion increment would be 0.25 to 1.4% of the residential waste stream (2% x .5 x .25 = 0.25%, 11% x 0.5 x 0.25 = 1.4%).

2.5 and 2.13Collection of all dry recyclables and household organics in a 4-stream wet/dry collection system

Performance of a 4-stream wet/dry system should be similar to a three-stream system, where overall waste diversion is typically around 50% or more.

2.6 Collection of Recyclables at all Multi-Family Dwellings

All multi-family households in buildings with 6 or more units will be provided with recycling service under the 3Rs Regulations. The impacts of extending the requirement to all multi-family households would vary from Region to Region, and would depend on the number of multi-family households in buildings of less than 6 units in each Region which are not currently receiving recycling service.

6.1 Centralized windrow composting of source separated organics

This technology would be an alternative approach (to in-vessel processing) to composting source separated organics collected from both the residential and IC&I sector by a number of systems considered. Organic wastes make up approximately 30% of residential waste, and 9% of IC&I wastes, therefore this technology would contribute to diversion of this stream. The potential to compost source separated organics successfully, in open windrow systems without causing odour problems for local residents has been tested at a number of sites (e.g. Mississauga).

6.2 Centralized Windrow Composting of Mixed Waste (third bag)
This technology would be an alternative approach (to in-vessel processing) for the mixed waste stream directed to composting in a mixed waste processing and composting operation. Diversion impacts would be similar to those stated for in-vessel systems (see Chapter 5, Service Technical Appendix, Volume 1).

6.9 Use Centralized Anaerobic Digesters
Central anaerobic digestion is a processing method which can be used for organic wastes (residential and IC&I) after they have been collected from source. It could replace, or be used in addition to central (aerobic) in-vessel or windrow composting plants. This component can contribute to diversion of up to 30% of residential waste stream, and 9% of IC&I waste stream.

8.5 Use State-of-the-Art Technologies and Techniques
Using state of the art technology and approaches is an important feature of all 3Rs systems. The impacts on waste diversion which are linked with specific technologies can only be estimated when the particular technique/technology is identified. It is assumed that state of the art approaches will always improve on the status quo. Each technique or technology will either improve diversion or system efficiency in some way. This component is therefore a benefit to the diversion system, with diversion achievements quantifiable on a case-by-case basis only.

10.1 No Unprocessed Waste to Landfill (Residential)
This approach can be accomplished in a number of ways. For residential waste, it can be accomplished by retaining source separation programs currently in place (which divert 19 to 35% of the residential waste stream) and adding a mixed waste processing and composting step for all remaining residential waste. Estimates (presented later in the technical appendix) show that an estimated 50 to 80% diversion of residential waste is achievable through this approach. If this policy were applied to IC&I waste, it is estimated to divert up to 60% of the IC&I waste stream.

10.2 Mandatory Source Separation by Residential Sector
The Region of Halton implemented a mandatory source separation by-law which resulted in a reported 20% increase in the quantities of material collected through source separation programs. It is assumed that the same impact could be experienced in other GTA municipalities, if this approach were adopted.

10.5 Require municipalities in GTA to achieve designated diversion targets
A waste diversion target can provide a focused requirement for achieving waste diversion. Assuming establishment of reasonable targets, with adequate collection, processing and market development for materials, this component would contribute to increased waste diversion. The exact amount would depend on the level of diversion begin achieved when the target was set, the infrastructure in place for waste diversion, the ability of the municipality to monitor and impact, on behaviour of the IC&I sector, the degree of commitment to 3Rs in the residential sector financial resources available, the reasonableness of the target and the implications of not meeting the target i.e. is there any cost or downside to not meeting the target.

10.6 Require municipalities in GTA to establish effective waste generation and diversion monitoring systems
By providing good information about waste generation and diversion, strengths and weaknesses of existing waste management systems can be identified. This provides the required information for adequate system design which should contribute to increased diversion of waste.

11.4 Allow residences to refuse delivery of unwanted junk mail
Unaddressed/unsolicited junk mail contributes approximately 87lb/hh/year (estimated by Recycling Council of Ontario) to the residential waste stream which converts to 15 kg/cap/year, based on an assumption of 2.6 persons/household. This equates to 3.3 to 4.6% of the residential waste stream. A portion of this is likely recycled by householders. However, assuming assistance by all residents and junk mail distributors (including Canada Post), to reduce junk mail by 50%, total reduction could contribute to diversion of 1.6 to 2.3% of residential waste.

11.5 Reject loads with visible designated materials
The practice of rejecting (or surcharging) loads with visible designated materials is well established in GTA. This component provides an incentive to proper source separation of materials that should result in increased waste diversion. Direct impacts that can be attributed to this measure have not been quantified.

11.6 Develop landfill management practices which utilize disposed waste as cover material
This component would focus primarily on some IC&I wastes which have reasonably uniform consistency, and may include materials such as foundry sand, shredder fluff and similar materials. Rather than be disposed in the landfill, they would be source separated and used as daily cover, thus eliminating the need to use borrow material for this purpose. This approach increases landfill life by putting waste material to a beneficial use. Cover material typically occupies up to 20% of a landfill's capacity and this could save a portion of landfill capacity typically occupied by cover material. In addition, some materials have properties that make them suitable as cover material at a thickness less than is required when using traditional soil cover. If these are materials which would otherwise have been disposed in the working cell, then their use provides three benefits: reduction in the volume taken up by cover requirements; beneficial use of material which would otherwise be disposed, and savings in developing a new borrow pit.

11.7 Produce compost on-site for landfill cover and preserve capacity
Wet organic materials, including leaf and yard and household kitchen wastes would be collected separately and composted at the landfill site (or at a separate composting facility). Compost produced would not have to achieve top quality standards, as it would be used immediately as daily cover on the landfill, replacing the need for borrow material. This component has the benefit of developing a ready market for "inferior" compost materials. This use of organic materials could divert quantities similar to central composting and preserve landfill capacity by displacing borrow material with material which would otherwise have been disposed as waste.

11.8 Volume based disposal fees
At present, disposal fees are usually based on weight of materials disposed. A switch to volume based disposal fees is likely to provide an incentive to decreased disposal of materials which are bulky and of greater volume but for which disposal is based on weight. The exact impact of the component is linked with the exact fees chosen.

12.1 Strong Educational Programs at All Educational Institutions (Schools, Universities, Colleges, etc.)
Strong 3Rs educational programs at all educational institutions would promote increased awareness and knowledge of 3Rs. This would have an impact on waste diversion in both the short and long term by making young people conscious of a conserver lifestyle, where waste generation is reduced. Impacts on waste diversion are difficult to estimate, because of lack of information on long term impacts of education on 3Rs behaviour, but is assumed positive.

13.3 Grant programs to support source reduction in residential sector
Grant programs can be developed to encourage development of community programs to support waste reduction in the residential sector. Grants may be applied to promotion and education programs, developing local waste exchange initiatives etc. The grants act as an incentive to community action, and can lead to increased waste diversion. It is difficult to measure the direct impacts of this type of program, and information on the incremental waste diversion impact is not available at this time, however, over time the impacts could be up to 1% reduction of the residential waste stream.

13.4 Full cost accounting forcing municipalities to charge the full or total cost of waste management
This component would remove any subsidies of waste disposal at the municipal and residential level. Residents would be aware of the full cost of waste disposal (through itemized tax bills etc.). Tipping fees would reflect the true cost of waste disposal. If the cost of disposal is greater than the cost of waste diversion, this component may therefore provide increased incentives to diversion. However, in GTA, costs of disposal are presently between $50 and $70/tonne and this is likely close to the true cost of disposal and the actual impact of the policy would be limited.

Charging the full cost of waste management to householders (as in a Direct Cost System) significantly impacts on diversion behaviour, and would increase residential diversion significantly in all GTA Regions.

14.1 Integrate waste diversion with economic development programs to create markets for secondary materials
Developing markets for secondary materials is a key issue in waste diversion. If adequate markets are not available, materials must be warehoused (if not landfilled), which reduces the cost-effectiveness and overall waste reduction effects of the program. Creating local markets for secondary materials will stabilize demand, and provide sustainability to programs. However, many local market development programs are small rather than large scale. At this time, the direct impacts of this measure on local diversion have not been measured, but are assumed to be positive, particularly if larger industries, which can use all of the locally collected recyclables as feedstock, can be established.

14.2 Mandate product stewardship with requirements for market development
Market development is an essential element of a full scale product stewardship program. The German Green Dot program is experiencing severe market related problems at this time, partially due to inadequate market development efforts prior to the program launch. Overall recovery targets for sales packaging materials were set at 72% diversion each for glass, tin and aluminum, and 64% diversion each for cardboard, paper, plastic and composites by weight. These targets require collection of 80% of materials available (by weight) and sorting of 90% of the collected quantities (Warmer Bulletin, May 1993). These targets are to be met by July 1995 and include marketing of materials. To date, in Germany, overall diversion has been limited to approximately 30% of materials recovered, with the remaining 70% being landfilled (Saul, May 1993). This problem results from inadequate market structure for recovered materials, high system costs (that were inadequately predicted) and confusion with division of collection responsibilities (between the municipal and private sectors).

Over time, with careful attention to details, it is expected that this component could result in recovery of 80% to 90% of packaging (25% of residential waste), thereby contributing to diversion of 20% of residential waste (all dry material). Some of this material is currently diverted through existing programs (BioCycle, June, 1993).

15.1 Expand Blue Box system to cover all IC&I facilities who want to participate, with focus on institutional and commercial

Currently, in various municipalities (e.g. City of Toronto) some small IC&I generators (restaurants etc.) are incorporated in Blue Box collection systems. By providing a convenient service to more IC&I facilities, waste diversion is increased. Expanding this service to a wider range of institutional and commercial facilities would avoid the need for identifying and organizing alternative collection systems for recyclable materials. By providing a convenient opportunity to recycle to more IC&I generators, waste diversion from this sector would increase. The impact of this measure would depend on the number and type of generators that would receive this service.

15.2 Provision of bins at major IC&I facilities (e.g. hospitals, schools, shopping malls etc.)

Providing recycling bins at IC&I facilities would increase convenience of waste diversion at IC&I facilities and help promote recycling in this sector. Specific impacts would be linked with the number and types of facilities providing bins and their subsequent use of the infrastructure. Impacts of this component would depend on the number of facilities involved.

15.8 Short term (3 to 6 month) storage of IC&I materials to take advantage of emerging technologies and/or market prices

This component provides protection against poor market prices for secondary materials by providing the opportunity to store materials and benefit from stronger prices as they increase. This removes a possible economic disincentive to waste diversion and is likely to contribute indirectly to increased waste diversion. Specific impacts of the component depend on the materials involved, and for that reason, at this time, no specific diversion impact is estimated.

16.5 Use centralized anaerobic digesters

See comment on 6.9

19.5 Replace collection and processing equipment and approach with state-of-the-art technology world wide (from Japan, Germany etc.)

See comment on 8.5

20.5 Require retailers and/or producers to establish recovery systems for designated products and packaging

Packaging constitutes approximately 25% of residential waste (Franklin, 1988). Packaging reduction is recommended as a voluntary means of source reduction through NAPP, and is mandated for certain sectors by the Ontario 3Rs regulations. Packaging recovery systems are being established or are under consideration in a number of jurisdictions.

See comments on 14.2.

20.6 Deposit/refund system for soft drink containers

By imposing a deposit/refund system on soft drink containers, an immediate incentive to waste diversion is provided at the consumer level, which can contribute to high recovery of the materials involved. If applied to beverage containers (which constitute 2% of the residential waste stream), the incremental diversion associated with this component would be 0.2% of the residential waste stream, assuming that 70-90% (assume average 80% for this discussion) of these containers are currently recovered through Blue Box programs, and that a deposit/refund system would increase recovery to over 90% (2% of waste stream x assumed 10% not recovered). The incremental impact would be diversion of 0.4% of the waste stream if only 70% is recovered through existing programs.

See comments on 1.19

20.8 Mandatory recovery rates and targets for specific materials
This component involves government (usually at the provincial level) mandating a specific recovery rate for designated materials. This approach has been used in a number of jurisdictions. It further involves developing the adequate infrastructure to support recovery of the materials and ensuring public participation in the scheme. Should these conditions be met, this component increases waste diversion, with specific impacts of the component dependent on the recovery rates established and on the materials that are mandated.

20.16 Mandated levies or taxes to support 3Rs
A levy or tax placed on designated materials is expected to a have a dual benefit. First, it could be applied against any material (such as the use of virgin newsprint) to help encourage resource efficiency and stimulate demand for recycled materials. Secondly, it could provide a pool of funds to expand or support existing or developing recycling programs and infrastructure. A levy or tax in support of 3Rs programs would therefore contribute to waste diversion. The exact impact would be quantified by identifying levy or tax targets and potential uses of funds generated.

21.1 Change approval process to require new IC&I facilities to design for reduction and re-use
Regulations would be required mandating development of reduction and re-use plans prior to approval of new IC&I facilities. Plans would be submitted to authorities prior to obtaining approval for new facilities. Waste diversion would be increased by planning in advance for reduction and re-use in facilities (providing adequate space, etc.). In addition, if the approval process included requirements for use of recycled content materials in buildings, it would stimulate markets for these products, and contribute to the sustainability of diversion systems.

21.2 Establishment of central food waste management organization
See comment on 1.24.

21.3 Allow locations to refuse delivery of unwanted "junk mail"
Unaddressed/unsolicited junk mail contributes a sizable portion of mail received in IC&I locations annually. By permitting or assisting IC&I facilities to refuse delivery of junk mail, waste would be reduced at source, contributing to waste diversion. The specific impact of this component on IC&I waste has not been measured. The percentage of IC&I waste which is junk mail is not known.

21.4 Develop and implement a material use guideline
Development of a material use guideline covers a number of different activities and materials (such as a guideline on appropriate materials to use as backfill, potential uses for various waste materials etc.). The direct effects of this component would depend on the materials involved, and current management practices.

22.1 Strong Educational Program at all Education Institutions (Schools, Universities, Colleges, etc.)
Strong 3Rs educational programs at all educational institutions would promote increased awareness and knowledge of 3Rs. This would have an impact on waste diversion in both the short and long term by making young people conscious of a conserver lifestyle, where waste generation is reduced. Impacts on waste diversion are difficult to estimate, because of lack of information on long term impacts of education on 3Rs behaviour, but is assumed positive.

22.4 Establish databank on waste reduction technologies and system design
Using up to date technology and system design is an important feature of all 3Rs systems, contributing to efficiency and a high quality of secondary materials. Establishing a databank

on waste reduction technologies and system design would contribute to waste diversion indirectly by ensuring that information on the most appropriate technologies is available.

23.2 Grant Program to Support Source Reduction
Impacts of grant program would depend on generators to whom grant is provided, and the technologies/approaches involved. This program would promote development of new methods and technologies which would reduce waste. If transferable to other sectors, the grant program would have impacts on reduced waste generation over the long term.

23.4 Self-imposed levies by producers to promote 3Rs
Voluntary "product stewardship" initiatives have been launched in several sectors (e.g. Black & Decker has instituted a $5 rebate to customers who return old appliances or tools for recycling) (Creed, April, 1993). The most famous such program is the German Green Dot program where companies formed a corporation to set and administer levies designed to finance development of a nation-wide recycling infrastructure for all consumer products.

Such levies can take any number of forms, and can be applied at any level, and on any product or group of products. The impact of this component cannot be measured without details of a specific program. The component would contribute to waste diversion by providing opportunities for recycling, potential incentives to consumers to recycle or through support of 3Rs initiatives through market development.

24.1 Funding and incentives to recycling industries and other industries that utilize secondary materials
By providing funding and incentives to recycling industries and others to support utilization of secondary materials, market development would be supported. This would indirectly lead to increased diversion by promoting existing and potentially expanding new markets for secondary materials. Impacts on waste diversion are linked with levels of funding, targets and materials supported.

Providing financial support to industries that utilize secondary materials would help establish these industries in GTA. This in turn would stabilize markets for secondary materials, by creating a steady, local demand, and would contribute to the long term sustainability of 3Rs.

24.2 Funding incentives to product manufacturers to utilize secondary materials
Funding incentives would support market development for secondary materials, stabilize markets for secondary materials, and possibly lead to increased waste diversion.

24.6 Purchasing specifications to promote recycled content
Companies that develop purchasing specifications promoting recycled content contribute to waste diversion through market development. Several companies are moving into this area. For example, Rubbermaid utilizes secondary LDPE stretch film for plastic and rubber products, and Proctor & Gamble and Lever Brothers use recycled boxboard in detergent board boxes (Faulkner, September 1993). This component contributes indirectly to waste diversion. Given competitive prices and a high quality of secondary materials, it is expected that companies will increasingly incorporate recycled materials in their purchasing specifications and waste diversion programs will have stable markets for processed materials and will continue to increase as a result.

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SCHEDULE B

SOURCE REDUCTION AND OTHER WASTE DIVERSION CONSIDERATIONS

SCHEDULE B-1 — SOURCE REDUCTION

Reduction measures rank above recycling on the waste management hierarchy, and should be used as much as possible for waste diversion prior to consideration of recycling strategies. Source reduction includes the design, manufacture, purchase and/or use of products and materials in a way that reduces their amount and toxicity before they are disposed. The term "source reduction" is used here to include only "those measures that reduce materials that have the potential to become solid waste before they enter the solid waste stream" (source - WRAC Roadmap). Source reduction, in the context of this report also includes reuse. Reuse refers to using a product as many times as is possible in its original form.

Waste reduction activities eliminate waste before it can occur by making waste generators aware of how their actions and choices can influence the production of waste. Source reduction programs offer significant waste diversion potential and avoid the need for waste collection, processing and disposal.

In general, source reduction measures include:

- reducing product volume and packaging (e.g. "lightweighting" packages)
- increasing product life and durability
- purchasing products selectively and decreasing product consumption (for example buying bulk, borrowing items, buying products in recyclable packaging, etc.)
- promoting re-use (e.g. refillable packages, reuse centres)
- promoting practices which decrease waste generation such as alternative landscaping, xeriscaping, grasscycling and backyard composting (for the purpose of the GTA 3Rs analysis, backyard composting is categorized as recycling).

These measures are achieved through changes made by designers, manufacturers, and consumers (individuals and businesses). Canada's National Packaging Protocol (NAPP) has established a goal of a 50 percent reduction in packaging waste by the year 2000 and specified that one half of this total reduction be achieved through source reduction measures. However, individuals and municipalities can also play an active role in making source reduction happen locally.

Individual Actions

Each individual makes decisions and takes actions that determines the amount of waste they generate. Actions and choices that individuals can undertake to reduce waste at source include:

- **purchasing choices**: to reduce waste, consumers should look for products that are durable, come in refillable packaging, have less packaging and, if possible, are available in bulk;
- **alternatives to disposal and recycling:** whenever possible, individuals can look for ways that an item can be reused rather than disposed or recycled. Repairing broken items, selling items at garage/rummage sales, altering clothing and giving items to charity are all viable alternatives to generating more waste;
- **not purchasing an item to begin with:** looking for ways to avoid purchasing an item to begin with can prevent the ultimate disposal of an item. Borrowing, renting or recognizing that an item isn't necessary (ie, deciding not to buy it) can be considered source reduction.

Municipal Actions

Municipalities play a large role in source reduction through their influence on residents and businesses. A range of activities for municipalities to undertake to maximize source reduction are listed below:

- **community outreach:** Because an individual's level of understanding of waste generation affects their ability to choose appropriate actions, municipalities should involve themselves in source reduction education and awareness. Municipal programs should provide information and assistance to individuals and companies to enable them to undertake voluntary source reduction efforts.

  Examples of community outreach activities are:

  — education workshops, such as a Master Composter program and shopper awareness campaigns
  — brochures explaining source reduction actions
  — developing school curriculum
  — public service announcements on radio, TV and in newspapers
  — labelling of products and packages that minimize waste (similar to the national *Eco-Logo* program)
  — giveaways of waste minimizing items such as cotton shopping bags and portable mugs
  — directories/guides for repair, rental and used goods services

- **incentives:** Financial mechanisms are used to encourage waste generators to decrease their garbage and to stimulate new business development focused on source reduction. Example of financial incentives include providing grants to individuals/companies to research product and packages that reduce waste, providing "prizes" to individuals/businesses that achieve exemplary source reduction, and providing funding to source reduction businesses such as reuse centres.

- **disincentives:** regulations, restrictions and taxes are examples of disincentives to waste production. Source reduction can be encouraged when taxes are levied on disposable and/or excessively packaged goods, bans are placed on the sale of a packaging material or product, and landfill bans are imposed on a given material. Other disincentives include volume-based disposal rates and disposal surcharges on certain materials.

- **forums:** providing forums for source reduction can encourage participation and awareness of reduction possibilities. Such forums include holding community "SWAP" days, on-line computer waste exchanges and meetings for information exchange.

It is equally important for a municipality to lead by example. Incorporating purchasing polices that reduce waste at the source and practicing measures that reduce waste (internal reuse of materials, donations of usable goods to non-profit agencies, grasscycling, etc.) indicate to observers that source reduction is not only favorable, but practical.

The creation of a Waste Reduction Office also shows commitment to waste reduction efforts and ensures that the municipal focus on waste *reduction* (before recycling and disposal) is not lost. A Waste Reduction Office would be responsible for promotion and education, ensuring

that the forums are in place for individuals and businesses to participate effectively, and that existing programs are successful.

Reduction Targets

Several jurisdictions have established source reduction targets for the year 2000. Some of these include: 8-10% for New York State, 10% for the State of Massachusetts, 13.5% for Berkeley, California and 15% in the Town of Markham, Ontario. Most of these communities are relying on backyard composting to help them achieve their targets. In the case of Berkeley, California, backyard composting is estimated to contribute 6% to the source reduction target.

Other jurisdictions have implemented programs to promote source reduction, but with lower anticipated targets than those mentioned above. For example:

- the City of Boulder, Colorado introduced the term "precycling" to increase consumer awareness about ways to minimize waste through effective changes in shopping behaviour and attitudes. The campaign features in-store promotional and educational activities, school educational programs and a media launch. These activities are anticipated to achieve 3% reduction of the waste stream.

- the City of Blane, Minnesota has embarked on a demonstration program to achieve 5% source reduction through a series of educational programs and activities. Approximately one-fifth of the City's 10,000 households have been targeted to receive printed materials, promotional kits and attend neighbourhood workshops promoting source reduction in the home. The program also involves monitoring the residential waste stream throughout the study in an attempt to quantify the reduction.

- the State of Rhode Island's source reduction activities include direct cost programs, backyard and commercial on-site composting, materials reuse, waste exchanges, public education and consumer awareness programs. Through this diverse program, the State anticipates a reduction of waste of up to 10%. (SRMG, 1993)

Limitations of Source Reduction

There are some limitations to the applicability of source reduction programs. These include:

- source reduction measures are difficult to quantify due to inability to determine if waste reduction was the direct result of a source reduction effort. In some instances, reduction may have occurred as a result of illegal dumping, private recycling activities, etc.;

- the public is very consumer-oriented and not easily convinced that "less is more";

- promoting source reduction in an integrated and consistent manner is difficult due to the often contradictory messages from marketers, environmental groups and the various departments and levels of governments;

- municipal experience is somewhat limited in the execution of waste reduction programs;

- programs are often considered to be "high cost" relative to their tangible returns.

Feasible Source Reduction Targets for the GTA

Residential waste stream

Because of the limitations in available data, and the uncertainty regarding future source reduction of residential waste, source reduction attributed to only two factors is included in residential waste diversion estimates. These are:

- NAPP; and
- increased education.

The National Packaging Protocol (NAPP) has targeted a 50% overall reduction in the packaging waste stream by the year 2000, relative to a 1988 baseline. Source reduction is the preferred option among the 3Rs. It is an objective that fifty percent of waste diversion shall be achieved through new source reduction and new reuse initiatives with recycling making up the remainder (National Taskforce on Packaging, 1993). Assuming that packaging constitutes 30% of the residential waste stream, this would lead to a 7.5% overall reduction by the year 2000. For the purpose of this study, a conservative estimate of 7.5% waste diversion through source reduction by the year 2015 has been adopted. A uniform source reduction rate of 0.33% per year has been assumed to achieve this value.

A further reduction, attributable to increased public education about waste reduction and reuse, has been assumed for this study. It is assumed that by 2015, an additional 0.5% reduction would be gained by extending the life of durable goods, reusing and repairing items, buying food in smaller quantities, using leftovers, etc. A uniform rate of 0.02% per year has been assumed to achieve this value. These figures do not take into consideration the effects of a ban on the collection of grass clippings and other yard wastes.

Therefore, from a baseline year of 1992, to the year 2015 (23 years), source reduction is assumed to reduce the weight of residential waste disposed by a total of 8% achieved in the year 2015. An estimated 3% source reduction value is reached by the year 2000.

IC&I Waste Stream

Source reduction of IC&I waste in the future is attributed to at least three major factors, which are:

- changes in the employment profile of each GTA Region;
- innovation by IC&I generators;
- innovation by the C&D sector.

The methods used to estimate source reduction as a result of these three factors are described below.

Source Reduction due to Changes in the employment Profile of each GTA Region:
Future employment in each major IC&I sector in each Region was compared to current employment to determine if there was a major shift towards IC&I groups which have traditionally been lower waste generators. The IC&I per employee generation rates were used to adjust future IC&I waste generation estimates. This was carried out by assuming that regional IC&I waste generation would continue at the rates experienced around 1987. Changes in generation as a result of employment shifts to different industries in each GTA Region are presented in Schedule O.

Source Reduction due to Innovation
The IC&I sector (excluding the construction and demolition sector which is addressed separately) is expected to reduce the generation of some wastes over the planning period through modernization, process change, increased operational efficiencies, etc. While it is generally accepted that this trend is occurring and will continue, because of global competition, etc., very little quantitative data are available on the impacts of this trend on future IC&I waste generation for the whole IC&I sector. Many case studies quote exceptional programs where significant reductions have been achieved (some are described in Schedule O). However, these are high profile examples of innovative behaviour and cannot be applied to the total IC&I sector for waste generation estimates. A modest source reduction allowance of 0.5% per year in waste reduction, starting in 1993, and continuing to the year 2015 (when the reduction increment would be 11.5%) was used for this analysis.

Source Reduction in the C&D Sector
Construction and demolition waste was separated from other IC&I waste for this study, as its method of generation is different to other IC&I wastes. The construction and demolition industry will also innovate, and continue to develop more efficient construction methods. An allowance of 0.25% per year, beginning in 1993, and increasing by increments of 0.25% per year from 1993 to 2015 was applied to estimate source reduction in C&D waste generation each year. On this basis, reduction of C&D waste would reach 5.75% by the year 2015.

These estimates result in an overall source reduction of 5% of IC&I waste by the year 2000, measured against a 1992 baseline, and 17.2% by the year 2015, measured against a 1992 baseline.

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Table B1-1
Summary of Selected Source Reduction Programs

Program	Description	Results
SHOPPER AWARENESS CAMPAIGN Seattle, Washington	• the Shop Smart program promotes waste reduction at the point of purchase in grocery stores through providing information on wise purchasing choices, in-store events, volunteers and media opportunities. • the areas of focus are: minimal packaging, recyclable packaging, recycled-content packaging and reusable products • volunteers are trained on packaging waste reduction and then go to grocery stores to staff displays and give tours. Volunteers also attended community events. • Choosey, the program mascot appears on all promotional materials • shelf talkers are used on "Smart Choice" products • Choosey appears on canvas shopping bags that are used as give-aways • preprinted post cards and lists of manufacturers' addresses and toll-free phone numbers are provided to encourage shoppers to register complaints and compliments about products and packaging • rebates are offered for reusing bags • labels are put on the bottom of "non-Smart" choices to indicate how much more expensive the products are than "Smart" alternatives • kick-off events were held at each store	• effective because most people shop at the same store on a regular basis • a 14% average increase in bag reuse was noted in the first 4 months of the campaign • program was most successful when volunteers were at the stores • first year program costs were $95,000. On-going costs expected to be $25,000
SHOPPER AWARENESS CAMPAIGN West Palm Beach, Florida	• the Solid Waste Authority promotes solid waste diversion through an "Environmental Shoppers List" and school curricula • the Shoppers List promotes packaging reduction, recycled content, recyclability and environmentally-benign products • the List is stuffed into a reusable canvas shopping bag and distributed to residents on request • program is promoted through newspaper ads, special events and presentations • utilizes volunteers • $12,000 from a state grant has been allocated for this project	• an average of 150 bags are distributed monthly
COMMUNITY REUSE EVENT Collingwood, ON	• the local Optimist's Club organized a SWAP day (similar to a garage sale) • residents were asked to bring any reusable material (clothing, furniture, goods, etc.) to a community centre for donation to this fundraising event	• 85-90% of goods were sold and over $6,000 was raised
PROMOTION OF REUSE CENTRES Los Angeles, California	• the City develops and circulates brochures indicating the location and activities of thrift shops throughout the City	• 1.3% of the total waste generated is diverted through thrift shops and garage sales
REUSE CENTRE "WASTEWISE" Halton Hills, ON	• WASTEWISE is a community-based resource centre and diversion facility that is funded by all levels of government, some businesses and individuals • utilizes volunteers, in addition to paid staff • there are 4 different components to WASTEWISE: 1. education centre and information service 2. reuse centre which accepts and sells office furniture, household goods, etc. Items are sold by weight 3. repair area where volunteers and community groups repair broken appliances, tools and equipment 4. recycling depot for items not accepted in Blue Box	• in their first 15 months of operation, they diverted 109 tonnes of materials from 25 organizations

Program	Description	Results
REUSE SYSTEM San Francisco, California	• Bay Area Collective Reuse System retrieves and distributes a wide variety of reusable discard for use by the community • provides publicity and education on reuse • donations are tax deductible	• reduced cost of waste hauling services • diverted 300 tonnes over 2 years
WASTE EXCHANGE Caledon Reusable Goods Exchange	• salvage centre adjacent to landfill • residents can bring or take non-hazardous items • also includes a textile drop-off box for Goodwill • shed to protect clothing and furniture	• estimate 75 tons diverted from landfill
WASTE REDUCTION OFFICE Centre South Hastings	• the municipality established a waste reduction office and hired a waste reduction officer to implement and coordinate a number of waste reduction and reuse programs. • projects currently underway include information packages designed to assist local businesses and community services in source reduction, monthly newspaper articles, developing a local "grasscycling" program, developing reuse directories and starting a reuse centre	
MUNICIPAL WORKSHOP Berlin, Germany	• the Berlin model for waste reduction was conducted with 50 volunteer families • participants were educated by trained consultants about the problems of managing residential waste and opportunities for reduction • after training, families source separated 6 categories of materials, weighed them and kept detailed records • quantities and percentages of waste materials generated were measured prior to, during and after the educational program	• overall, a 15-20 % waste reduction was achieved; prior to the program, each household produced 4.47 kg per day; during training, waste quantities dropped 20%; after training, quantities rose by 15%; and finally, after a renewed education program, it was reduced by 30%
GRANTS Metropolitan Toronto, ON	• Community Action Waste Reduction Grants Program was initiated in 1990 to provide support to community and environmental groups in their efforts to develop innovative programs to encourage 3Rs activities • projects funded include 3Rs booklets and community composting projects	• over 14 projects were funded for a total of $88,562
LABELLING IGA in Belleville, ON	• an independent IGA grocery store features an "Ecotag" program which labels products according to their environmental preferability. Every product on the shelf is given one or more of the following labels: *Best Packaging, Recommended Recyclable, Earth Preserver*	• results of survey indicate that some customers changed their buying habits as a result of the labels
COMMUNITY OUTREACH Cologne, Germany	• a 2 year study to determine the potential for waste diversion with a focus on source reduction • education was the main tool to promote source reduction. Activities include: information offices, information booths at markets and street dances, information distributed to schools and community associations, a telephone hotline, door-to-door contact and special information events • the information booths and the schools education were particularly successful • good communication was established through letters to churches and community organizations	• 6% reduction attributed to source reduction • an additional 11% increase in source separated materials achieved • project costs for study were $800,000

SCHEDULE B-2 — PROMOTION AND EDUCATION

Implementation of a waste management strategy will change the way individuals and organizations think about and manage their waste. Economic incentives will be introduced, new policies and laws will be put in place, new collection and processing infrastructures will be developed for recycling and composting, and new planning and data gathering requirements will be established. To ensure that residents and businesses understand and support these changes, public education and promotional programs must be developed.

Education is a tool used to transfer information to a particular audience. Some educational programs are long-term campaigns designed to bring about behaviour change through awareness. Examples of such programs include developing school curriculum and encouraging shoppers to avoid over-packaged goods. A **promotion** program will motivate people to participate in a particular program, and inform the audience of a particular topic or event, such as the start of a new recycling program.

A promotion and education program is essential to achieve the following:

- to create widespread awareness of waste diversion activities taking place in the community;
- to motivate people to participate in current and new waste reduction programs (e.g. backyard composting, source reduction activities, IC&I activities, etc.). Higher participation rates will directly affect program success;
- to give residents detailed information on exactly what to do and how to do it. Residents must be familiar with how to properly sort and prepare materials to help the hauler increase the collection efficiency at the curb, and to meet market specifications;
- to ensure ongoing participation in recycling and waste reduction programs;
- to give positive recognition to the community for their efforts (to encourage residents to continue participating in waste reduction programs).

Some promotional techniques can also be used to evaluate a program. For example, a feedback mechanism such as a survey can be implemented to encourage residents to comment and make suggestions as to how the program can be improved.

However, to maximize the effectiveness of promotional and educational activities, a strategy must be developed.

Promotion/Education Strategy Development

There are eight steps in the development of an effective promotion and education strategy. Those are:

1. Conduct an audience research program
2. Establish goals and objectives
3. Develop formal communication plans
4. Target your audience
5. Select appropriate media
6. Coordinate efforts of participating organizations
7. Foster public input and participation
8. Allocate adequate funding

1. Conduct an audience research program: The better a municipality understands the demographic make-up, attitudes and behaviours of its residents, the more effectively it can deliver programs that will positively impact them. The purpose of audience research is to determine current awareness of waste minimization and management, identify effective programs, assess which communication tools would be effective and receive feedback on existing programs. Research can be as sophisticated as a large-scale survey done by an independent research company, or as informal as a verbal survey of callers to the recycling hotline.

2. Establish goals and objectives: Clear goals and objectives are essential to 3Rs education. Some examples of goals and objectives are: encourage manufacturers to design and manufacture products and packaging that minimize waste, encourage waste minimizing purchasing habits, inform residents how to compost, teach people how to close the loop through purchase of recycled materials, etc.

3. Develop formal communication plans: Solid waste managers should prepare formal communication plans to guide their education and promotion efforts. Such plans would describe goals, objectives, target audiences, core messages and details of specific programs (if available). These plans provide a framework for the strategy.

4. Target your audience: Education programs should be targeted to specific audiences. Although most education and promotion is geared towards the "general public", more effective campaigns are those that are targeted towards a specific audience. Some considerations to be made when targetting audiences are:

- age
- housing type
- language
- interest groups
- cultural and religious affiliations
- gender
- location (rural vs. urban)
- community associations
- purchasing practices

5. Select appropriate media: Based upon audience research and chosen target audience, an appropriate medium must be selected. Most strategies employ a selection of the following media:

print	visual and audio	activities/events
brochures	radio ads	tours
newsletters	television ads	presentations
flyers	hotlines	visits to households
calendars	info booths	in-house seminars
newspaper ads	displays	workshops
direct mail	billboards	school curriculum
door hangers	press events	green shopper program
error notices in blue boxes	posters	fairs
	videos	contests
		committees

Most waste managers tend to rely on print for the majority of their promotional and educational activities. Although print is generally the least expensive media, experience suggests that personal contact is more effective in changing people's values and beliefs.

6. Coordinate efforts of participating organizations: Ongoing coordination between organizations responsible for education and promotion programs should be conducted to give core messages greater strength and to increase program efficiencies.

7. Foster public input and participation: Through participation in education activities, residents are afforded the opportunity to "buy into" the waste management program and its goals. Through participatory events , such as community workshops, master composter program and tours of recycling facilities, people gain a sense of ownership and responsibility for their community's program, and are able to see tangible results of their efforts. Forums for public input and participation also provide an opportunity for feedback on existing and proposed programs, potentially making them more effective for the future.

8. Allocate adequate funding: Most successful 3Rs programs spend in the range of $2-4 per household per year on promotion and education activities. This budget item is not only essential to launch a program, but is required as an on-going expense because regular promotion and education that improves the quality and quantity of recyclables and decreases the volume of solid waste requiring disposal.

Limitations of a Promotion/Education Strategy

The success of promotional and educational strategies are difficult to measure and there has been minimal effort expended by existing programs to determine their success level. As a result, it can be difficult to secure funding for promotion and education programs and gauge the effectiveness of proposed and existing programs. Further to this, because of the relative youth of waste diversion programs in North America, there is little data available to determine which tools are the most appropriate for waste diversion promotion and education.

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Table B2-1
Examples of Promotion and Education Programs Focussing on 3Rs

Program	Activities	Description	Results
BACKYARD COMPOSTING Region of Durham, ON	• door-to-door delivery of brochure • at-home demonstrations • "problem" cards	• brochure notified residents of the backyard composting program and included a business reply card for delivery of a free backyard composter • home delivery of composters by students that demonstrated the "dos and don'ts" of backyard composting • "problem cards" left in Blue Boxes that have been set out incorrectly. The cards acknowledge the residents' participation and give them detailed instructions on correct participation	• 74% of residents accepted composters • diversion rate through backyard composters is estimated to be 256 kg/unit/year
MUNICIPAL WASTE REDUCTION AND RECYCLING PROGRAM Seattle, Washington	• brochures • calendars • newsletters • public advertisements on radio and TV	• brochure topics include variable can rates, composting food and pet wastes, individual source reduction actions, precycling, household hazardous waste, do's and don'ts of recycling, leaf collection program, etc.	• their aggressive and diverse campaign costs between \$3 and \$4 per household per year
CURBSIDE RECYCLING PROGRAM Vancouver, BC	• brochure • newsletters • municipal tax insert • blue box error stickers • telephone hotline • signage on recycling trucks • transit shelter advertising • radio ads • newspaper ads • press events	• brochure explains how-tos of Blue Box program. Available in Vancouver's main languages • bi-annual newsletter focuses on issues regarding waste reduction, upcoming programs and recognition of past successes	• estimated 85% participation • diversion of 12% of single-family solid waste
COMMUNITY VOLUNTEERS Boulder, Colorado	• securing and training of volunteers	• in each neighbourhood, a "block leader" promotes the local recycling program. One person is responsible for promoting and educating their neighbours on proper recycling procedures. This technique was particularly successful in apartment programs where there is a high turnover of tenants. The "block leader" assists new tenants with learning the recycling program.	• studies have shown that this approach can increase participation by 65%
MUNICIPAL WASTE REDUCTION AND RECYCLING PROGRAM Centre and South Hastings, ON	• householder information card • problem card • telephone hotline • video • newspaper, radio and TV ads • stickers • door-to-door promotion of backyard composting • mall displays • public talks	• program launch included a series of newspaper ads over a period of 3 weeks, press releases, a launch ceremony and press release kit • householder information card provides detailed information on recyclables and how to prepare them • problem card explains incorrect recycling • 30-minute video on recycling aired on local cable channel • stickers to promote the recycling program • backyard composting program is promoted by a number of staff that go door-to-door discussing composting with residents and offering free composters.	• high monthly participation rate (85%) in recycling program ; 450 lbs/hhld/yr • diversion of 35% • 70% of households contacted by compost staff took a composter. The cost of this program, including units, distribution, advertising and education is @ \$30/unit

Program	Activities	Description	Results
REGIONAL SOLID WASTE PROMOTION AND EDUCATION PROGRAM Greater Vancouver Regional District, BC	• municipal support programs • community outreach activities • schools education program • IC&I education programs • composting programs	• support to municipal solid waste programs includes a forum for recycling coordinator networking, promotion of municipal programs that occur in member municipalities, Compost Network for organizations involved in the promotion of composting, and a Waste Reduction Forum for individuals and organizations to interface • community outreach activities include: Talking Yellow Pages (for information on programs within the GVRD), Christmas Tree Recycling promotion, Telephone Book collection, 3Rs library displays, community special event guide, radio campaign, and participation in special events • IC&I programs include waste reduction kits and workshops • composting is supported by a regional compost demonstration garden, a composting network, partial funding of a composting hotline and the development of a "Master Composter" program	•
COMMUNITY WORKSHOP Maxville-Kenyon, ON	• community source reduction workshop • follow-up survey	• 25 families attended a source reduction workshop designed to teach them how to reduce waste. Participants were asked to monitor and record their waste before and after the workshop • a year later, a follow-up survey was conducted to determine if the education remained effective	• on average, dry waste reduced by 34% through shopping and behavioural changes, and wet waste was reduced by 66% through backyard composting • a year later, the survey indicated that most families maintained a 50% reduction level
MUNICIPAL ORGANICS PROGRAM Port Colborne, ON	• neighbourhood volunteer "block leaders" • employment of "Compost Doctors" • schools program • highly visible promotional campaign • promotion through schools, summer camps and local service groups • compost hotline • displays at summer events and local farmers' market • door-to-door canvassing for backyard composters • door hangers, brochures, flyers, etc. • newspaper advertisements • posters	• neighbourhood volunteer "block leaders" • employment of "Compost Doctors" • schools program • highly visible promotional campaign • promotion through schools, summer camps and local service groups • compost hotline • displays at summer events and local farmers' market • door-to-door canvassing for backyard composters • door hangers, brochures, flyers, etc. • newspaper advertisements • posters	• 81% of households were visited regarding backyard composter, and 82% of those households accepted a composter

Sources:

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SCHEDULE B-3 — LEAF AND YARD WASTE MANAGEMENT

General

Leaf and yard waste comprises approximately 16% to 34% of the residential waste stream (G&S, 1991 and 1992; W.R. Beck, 1992; Centre & South Hastings, 1993; Guelph, 1990). Materials include: leaves, grass, weeds, plant cuttings, twigs, hedge trimmings and branches.

Leaf and yard wastes are an obvious target for waste diversion programs because they represent a significant portion of the waste stream that is, by nature, already source segregated. In addition, the processed product of leaf and yard waste is a usable and often valuable product.

Another advantage of yard waste programs is the removal of grass from refuse collection, which because of noxious odours produced in its decomposition, is considered a hazard to refuse collectors and processors.

The percentage of yard waste in the municipal waste stream varies by jurisdiction due to geographical location (the longer the growing season the greater the percentage of yard waste in the waste stream) and the type of community (rural residents are more likely to deal with their yard wastes on-site than their urban counterparts).

Yard waste also has seasonal variations which must be accounted for in the development of leaf and yard waste programs. In the spring, the main yard wastes are brush, grass and some leaves. The summer sees mostly grass and brush. The autumn brings the leaves, along with some brush and grass. During the winter, the main "yard waste" is Christmas trees.

There are a number of ways in which leaf and yard wastes can be diverted from the waste stream, including,

- landfill bans
- grasscycling and mulching
- collection for centralized processing
- xeriscaping
- backyard composting

All of the above yard waste management methods are discussed in this section, with the exception of backyard composting, which is described in detail in Schedule C. Table B3-1 presents a brief description of a range of leaf and yard waste collection programmes.

Landfill Bans

Banning leaf and yard wastes from landfills can be an effective tool to promote reduction and at-home management by making it more difficult, costly or impossible to dispose of these materials. Bans can also provide support to existing programs aimed at collection and processing of leaf and yard wastes.

Bans are becoming more common as governments become more aware of their limited landfill capacities. In Ontario, the responsibility for establishing material bans at landfills or transfer stations has been placed on regional municipalities. An estimated 30 municipalities have initiated landfill bans and/or collection bans of organic materials (Varangu, AMRC). Many municipalities are implementing by-laws and disposal bans as a method to both divert waste and save money. In the U.S., a total of 21 states had implemented some form of landfill ban on yard waste as of October 1993 (Todorovich, 1993).

Table B3-1
Summary Information on Selected Leaf and Yard Waste Programs

Program	Materials Collected	Description	Data	Notes
Curbside Plastic Bag Program Omaha, Nebraska	• commingled leaves, grass and brush	• curbside collection of yard waste in any type of plastic bag is collected weekly between April 1 and November 30, using one-person side-loader vehicles • bags are broken open at the composting site by the windrow turner, and are removed manually • end product used as landfill cover	• vehicle does 500 stops per day • the contacted collector is paid $45.30/tonne • the compost site charges the collector $24.60/tonne tipping fee • diversion of 145 kg of yard waste per household per year • 14% diversion of residential waste stream in 1992 • 90% participation	• pilot program used rollout carts and biodegradable plastic bags. Use of carts discontinued because of cost and capacity limits. Degradable bags discontinued because they did not degrade properly at the compost site • implementing yard waste ban by September 1994
Curbside Paper Bag Program Vancouver, BC	• leaves	• residents purchase kraft paper bags from local retailers (5 bags for @$3.50) • curbside collection is done by municipal rear packers. Trucks pass by each household approximately every 4 days • leaves can also be dropped off, loose or bagged, at the City's transfer station or landfill • program operates from October to December • end product is used in municipal applications or sold to local landscapers and soil manufacturers	• in 1992, 5000 tonnes of leaves were diverted	• City is planning to do a full-scale yard waste collection program in the near future

Program	Materials Collected	Description	Data	Notes
Curbside Paper Bag Program Urbana, Illinois	• commingled leaves and grass • brush (bundled)	• kraft paper bags used for collection of leaves and grass; brush is bundled. Bags are purchased by householder • weekly collection from March to November using two-person rear packer trucks • bags are open primarily by the windrow turner • bags biodegrade in 4-6 weeks in windrows • end product is used in City parks and sold to private citizens and landscapers for $10 per cubic metre	• estimated that waste collected is 50% brush, 35% leaves and 15% grass by weight • collection contractor paid $16.50 per compacted cubic metre (@$40/tonne) • processing costs estimated to be $25/tonne • 2,090 tonnes of yard waste diverted in 1992 (1350 tonnes from residents) • 110 kg of yard waste is collected per household/yr • achieved 10% diversion of yard waste	• state-wide ban on yard waste at landfills • yard waste is second largest component of the waste stream • program originally used plastic bags • kraft bags cost $0.45 ea. when purchased in batches of 30,000
Curbside with Various Containers (75 L plastic containers, 110 L kraft paper bags, or NOVON polymer bags) Haddonfield, New Jersey	• commingled grass, leaves, small brush and garden trimmings	• weekly curbside collection of yard waste done on same day as refuse • residents can choose their preferred container • containers purchased by residents at 2 retail outlets ($1.35 for NOVON bag, $0.75 for kraft bag and $15.00 for plastic container) • collection is done by 2 person rear packer trucks • no debagging is required • program promo includes a flyer and ads in local newspaper and newsletter	• 65% of residential yard waste being diverted • participation estimated at 80-90% • private composting site has a $30/tonne tip fee	• NOVON polymer bags break down quickly in compost piles no residue in end product

Program	Materials Collected	Description	Data	Notes
Curbside Plastic Rollout Cart Program Municipality of Lunenberg, Nova Scotia (including Towns of Bridgewater, Lunenberg and Mahone Bay)	• all organic yard waste	• in a pilot project, residents provided with a 240 L roll-out cart for collection of kitchen and yard organics • collection done weekly in urban areas and bi-weekly in rural areas by a private hauler using standard rear packers modified with hydraulic lifting devices • composting done in windrows at local incinerator/landfill site • promotion and education includes letters sent to residents prior to implementation, news releases, workshops and follow-up letters	• 30% (79 tonnes) diversion of residential waste stream achieved through collection of yard waste (23%) and recyclables (7%) • less than 2% contamination in carts	• a program for collection of recyclables in blue bags was implemented at the same time
Yard Waste Drop-off Program Richmond, BC	• commingled yard waste	• residents drop off yard waste at a number of drop-off depots or at the private composting site free-of-charge • the City contracts haulers to transfer the waste from drop-off depots to the composting site • the private composting operation is reimbursed by the City based on the volume of waste received	• produces approximately 1,000 tonnes per year of finished compost	
Grasscycling Waterloo Region	• grass	• extensive promotion and education program, including information pamphlet delivered to each residence, radio ads, newspaper articles, signs on collection vehicles, Cable TV show, "problem identification tags" for bags containing grass left at curb	• estimated savings between \$25,000 to \$80,000 on tipping fees • estimated 500-975 tonnes diverted annually • cost of \$1 per household for promotion and education program	• Started in 1991 • conducted 3 pilot programs to discover the most effective way to divert yard waste from landfill • City implemented leaf and grass clipping collection ban after pilots • plan to ban all yard waste from landfill by 1994

Program	Materials Collected	Description	Data	Notes
Grasscycling Greenfield, Wisconsin	• grass	• the "Don't Bag It" lawn care campaign was implemented in 1992 to reduce yard waste • 1,350 homeowners pledged no to bag grass clippings • 52 residents were provided with Toro mulching lawnmowers for the duration of the project(summer of '92) • promotion and education included direct-mail brochures and opportunity for participants to win prizes	• cost savings to City of $3,500 for 1992 season • 90 tonnes of grass diverted	
Drop -Off for Grass Waste State College Borough, Pennsylvania	• leaves (collected curbside) • grass (collected in drop-offs) • grasscycling	• 5 drop-off depots (6'x6' enclosures) for loose grass located in city parks, • promoting backyard composting and grasscycling • drop-offs serviced by City's 2-person vacuum truck on a daily basis • operates April - October • grass is composted along with collected leaves • end product is used in municipal flower beds and tree planting, and placed at drop-off sites for public pick up	• 210 tonnes (730 cu.m) of grass clippings diverted in 1991 • capital and operating costs estimated at $1.10 per capita • each drop-off cost $520 to build	• the purpose of drop-off for grass is to provide an alternative to residents that isn't as convenient as grasscycling • leaves are picked up at curbside using a vacuum truck

Landfill bans can be easily enforced at the point of collection and at the landfill. The disadvantage of landfill bans is the increased tendency of generators to dump leaf and yard waste illegally (into bodies of water, onto the streets or into private refuse bins).

Before implementing disposal bans, systems must be in place to manage the materials to be banned. Residents must have the tools and know-how to react positively to yard waste bans. This includes educational material on at-home management options (backyard composting, grasscycling, mulching, xeriscaping) and access to collection programs for materials that cannot be managed at-home (woody waste, large volumes of leaves and grass).

Generally, a phase-in period is provided between ban implementation and enforcement. That is, in the start-up phase of the ban, warnings are given and more time is taken to ensure that residents are fully aware of the ban's restrictions and alternatives.

The City of Oakville estimates that it costs approximately $500,000 annually to collect grass clippings. In an effort to eliminate this operating cost and increase waste diversion, the City passed a by-law in June 1992 to ban the collection of grass clippings effective April 1, 1993. Grass clippings cannot be processed at Halton's composting facility due to restrictions imposed by the operating Certificate of Approval. Furthermore, there are concerns that lawn pesticides and herbicides may contaminate the compost product. (Jones, 1993)

Other Ontario municipalities such as Kingston, Waterloo and Ottawa have invoked similar bans on the collection of grass clippings. Unlike these communities, however, the City of Oakville decided not to provide grass collection depots for use by residents. This approach places the onus on the resident to deal directly with their yard waste. City staff hope this action will motivate residents to begin backyard composting, to mulch grass and leave it on the lawn, or switch to alternative landscaping techniques, such as xeriscaping. (Jones, 1993)

Grasscycling and Mulching

The process of mulching and grasscycling requires that residents leave their organic yard wastes, such as grass and leaves, on the ground for decomposition, rather than collect them up for disposal or composting purposes. This natural process whereby soil microorganisms are responsible for the decomposition and processing of yard wastes into organic matter, eliminates the need for the resident or the municipality to "manage" the waste materials.

Grasscycling refers to simply leaving grass clippings on the lawn. If done properly, this practice does not degrade lawn quality, as is commonly believed. Proper grasscycling requires the resident to: mow the grass frequently with a sharp bladed mower, mow the grass when dry, and mow the grass to a height of approximately 4 cm. If the cuttings result in a thick cover (over half an inch), the lawn requires holes to be punched in to allow the cut grass to fall through.

Leaves can be mulched, as well. The leaves require chopping, best done by a lawnmower. Chopped leaves can be left to winter on the garden or the lawn, spread to a thickness no greater than 6-8 inches.

Municipal governments can contribute to this waste management option by educating residents about the benefits of mulching and the how to do it, and following up the education with regular promotion.

Municipalities can also facilitate on-site management of yard waste by providing residents with a mulching service. Mulching can be done at a centralized area to which residents bring their yard waste to be mulched and then take the mulch back home, or a small mulcher can visit a neighbourhood on a regular basis to provide a mulching service for materials left at curbside (leaving the residents with the mulch).

Mulching of collected yard waste is often done by municipalities as a volume reduction method. Quite often this is done in the case of Christmas tree collections - the mulched trees can be offered to residents as free mulch, used in municipal applications as a mulch, or disposed of in a landfill (mulch has a significantly less volume than do full trees).

Collection for Centralized Processing

Collection of leaf and yard waste for centralized processing requires consideration of the type of collection vehicle and how the material is to be contained prior to collection.

Collection options include drop-off depots and curbside collection. There are a number of issues to consider when planning a yard waste collection program :

- **participation levels**; on a monthly basis, a typical drop-off location receives 2% to 25% participation, a curbside program receives 50% - 90% participation;
- **cost of collection**; drop-offs cost $5 to $35 per ton, curbside costs $35 to $90 per ton;
- **generation levels**; generation is affected by lot size, age of neighbourhood, housing density and type, and income level;
- **variability of weather**; volumes are greatly affected by weather - a year of unusual cold, warm, precipitation or wind can affect projected volumes and budget requirements ;
- **materials collected;** the range of potential target materials for collection include grass, leaves, clippings and larger brush. All or any of these materials can be collected in a variety of combinations - this decision is affected by the level of waste diversion and the quality of end product desired;
- **level of collection**; year-round or seasonal.

A drop-off depot is the least expensive option but with the lowest recovery levels (2% to 5% for periodic events and 10% to 25% for permanent sites) and participation is generally limited to those people with vehicles. Contamination is often higher than in curbside collection programs and there is potential for odour problems at unstaffed locations. However, many municipalities implement drop-off depots as an interim measure before going to a full-scale curbside program.

For curbside collection, the option of whether to collect the material in containers or loose must be considered. The form of collection is often determined by the type of existing equipment.

Collection of loose material is less expensive than for containerized collection (due to cost of containers) and contaminants are more visible. The disadvantages of loose collection are that it is more labour intensive, it often experiences difficulty with cars parked on the road, and that contamination from the street (dirt, stones) is inevitable.

Vehicles used for collection of loose material include mechanical scoops and vacuum machines. Mechanical scoops are generally attached to the front end loader or skid steer loader. There is a self-contained unit with a series of paddles to scoop up material onto a conveyor which empties into a dump truck. Vacuum machines are primarily used for leaf

collection and are not appropriate for grass collection. In addition, some vacuums do not work well on wet materials.

Collection of materials that are containerized has the advantages of easier loading, minimal curb/street mess and provides the program with some visible identity. The disadvantages of containerized programs are that they are more costly (for the residents and/or municipality), may require debagging equipment, are restricted to the size of the container, and contaminants are not as visible.

A number of container options are available; the main ones are plastic bins, plastic bags, kraft paper bags and degradable plastic bags.

Bins are durable and mobile, although they are the most restrictive in terms of capacity. For example, plastic bins generally cannot hold all the leaves generated in a fall raking session. The cost of these containers for single-family residences can vary from $10 for a standard plastic trash can to $75 for a 90 gallon semi-automated wheeled container.

Bags can accommodate varying volumes of material. In addition, they are more easily stored than plastic bins and are less expensive in the short term.

Plastic bags are an inexpensive option for collection ($.08- $0.10 ea.), but require removal at some point during the waste management process. Debagging can occur on the truck, before composting or after composting. The most popular plastic organics collection bags are see-through to allow collectors to see contaminants. Generally, when plastic bags are used for collection, some plastic remains in the final product, thereby reducing its marketability.

Degradable plastic bags have been used in some organics collection programs as a means to overcome the need for debagging. Although these bags are less expensive than kraft paper bags ($0.15 - $0.21 ea.), they generally do not decompose at the same rate as the yard waste and leave some quantity of plastic in the final product. There is little data available on the environmental effects of degradable plastic on compost quality.

Kraft paper bags can be shredded and composted along with their contents, thus not requiring any debagging. Kraft paper bags generally have a high degree of wet strength and can withstand some precipitation. Kraft bags however, are the most expensive of the bag options (from $0.25 to $0.75 each), will deteriorate after heavy dose of precipitation and do not allow the collector to readily see contamination. The Cities of Seattle and Vancouver have switched from using plastic bags to kraft bags in their leaf collection programs in recent years as a result of cost savings during collection and processing, and to increase the value of the composted material. (Biocycle, Sept. 1993 and Walker, 1994)

Collected leaf and yard waste is generally composted in a centralized location.

Xeriscaping

Xeriscaping is a method of landscaping/gardening that maximizes the use of perennial, and preferably native plants in order to reduce or eliminate the use of pesticides and herbicides, conserve water and minimize maintenance activities such as mowing. (MOEE brochure, 1993) Increasingly, communities have begun to promote xeriscaping activities at the residential and institutional level.

The Evergreen Foundation reports that in North America an estimated 40 million lawnmowers consume 200 million gallons of gasoline annually and that lawn owners consume one-sixth of all commercial fertilizers. Furthermore, it is estimated that up to 75%

of the costs associated with lawn maintenance could be saved by switching to more ecologically sound landscapes. (Vaughan, 1992)

In traditional xeriscaping, residential perennial gardens replace lawn landscapes. However, other environmentally beneficial landscaping and gardening activities are gaining popularity as well, including rooftop gardening, backyard vegetable gardens, native plant gardens in parks, low maintenance landscaping in parks and parkettes, and community garden plots.

Some Ontario municipalities have begun promoting xeriscaping and alternative landscaping. In the summer of 1993, the municipality of North York eliminated the use of pesticides and herbicides on parks and municipal properties (with the exception of playing fields) in an attempt to move towards a more natural landscape. Elsewhere in Metropolitan Toronto, experiments to transform parks (or portions of parks) and other municipal grounds to natural, low maintenance, self sustaining landscapes are underway.

Promotion and Education

As with all waste management options that require the participation of residents, regular and effective promotion and education is key to the program's success. Some examples of promotional and educational materials for leaf and yard waste programs are:

- brochures explaining at-home options for managing leaf and yard waste;
- notices in tax billings (tips for lawn maintenance, announcement of fall leaf pick up program, recognition of past success in diverting leaf and yard wastes, etc.);
- compost hotlines; to provide advice on grasscycling and mulching, to inform residents of municipal programs for leaf and yard waste, etc.;
- newspaper advertisements; announcements and reminders of municipal programs (e.g. Christmas Tree Chipping Program, Fall Leaf Collection, Grass Banned from Disposal, etc.);
- printing on leaf collection bags (promotes program when bags are on at curbside);
- signage on collection vehicles;
- billboards and transit ads;
- presentations to schools and community groups;
- utilizing volunteers to train their neighbours and "spread the word";
- television and radio advertising;
- press releases;
- demonstration sites (in local parks or municipal properties).

Although print media has historically been the education and promotion forum of choice for most waste management programs due to its relative low costs, experience suggests that nonprint media, particularly those that involve direct, one-on-one communication and participation, are most effective.

End Uses for Processed Yard Waste

The end product of yard waste collection and processing programs can take a number of forms depending on the degree of source separation of materials and the degree of processing.

Woody wastes, such as tree trimming and other brush can be chipped and used as mulch (in municipal applications such as parks and municipal greenhouses), or added to compost heaps (windrows) to assist in aerating the pile.

Other yards waste, such as leaves, grass and mixed yard waste are typically composted. The composting process, which biologically breaks down the organic matter, can vary dramatically depending on the type of materials included and the degree to which the material has been allowed to compost. For example, collection and processing of clean leaf waste to a point where the material is completely cured, ground and screened will result in a high quality soil amendment that can be bagged and sold commercially. The following list indicates, from high value to low value, end uses for processed yard waste:

- clean soil amendment (sold to private compost manufacturer);
- bulk product for landscapers;
- bulk product for use in municipal applications such as parks and roadside gardening;
- return to residents for gardening purposes (often at community events where residents can pick up leaf compost for free, or as part of a fundraising event);
- landfill cover;
- disposal in landfill (volume reduction only).

The range of end uses noted above provides an outlet for all collected leaf and yard wastes.

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SCHEDULE B-4 — MULTI-FAMILY RESIDENCE RECYCLING

Introduction

The diversity of multi-unit residences such as apartments, townhouse complexes, condominiums and cooperatives, represents a unique challenge to recycling program designers and operators. Consider the differing needs of a downtown high rise versus the need of a suburban townhouse complex. The building design and management of multi-unit residences such as these requires a variety of systems and approaches to both implementation and operation.

The challenge is further increased when the garbage removal system of multi-unit residences is taken into account. Because garbage removal is typically contracted privately, the garbage containers, service level and collection system vary from building to building.

Many multi-unit residences have historically participated in recycling programs on a building-wide scale as the result of a desire to reduce waste disposal costs or because of tenant demand. Now, however, the provincial waste management act requires that all residential buildings (with 6 or more units) put a recycling in program in place and the municipality must provide collection services to all these buildings. The challenge to have a successful recycling program for multi-unit residences is now faced by all municipalities, building owners and building managers.

Program design

The type of collection program implemented in a multi-unit residence generally depends upon the size of the building . For smaller buildings, the inclusion of their recyclables in the curbside Blue Box program is usually the most effective system. For larger buildings, a centralized area for the collection of recyclables is put in place and residents are generally required to bring their recyclables to this central point. This type of collection program will be the focus of this section.

Small Buildings (less than 10 units)

Residential buildings with less than ten units can usually be serviced through a curbside Blue Box program where the Blue Boxes are placed at curbside for municipal collection and are collected by the same vehicles that service the single-family homes.

There are two primary manners in which residents participate in a program of this type. In the first manner, each unit in the building is given a Blue Box in which they first place their recyclables and later bring the box to the curb, such that they are treated much like a single family resident. In the second manner, a number of blue boxes are placed in a central area into which residents can place their recyclables. These communal boxes are then placed on the curb by a building superintendent or designated resident. In the instance of a centralized collection area for recyclables, the issue of whether or not to have an in-unit collection container (e.g. a blue bag) must be decided.

The choice between these two in-building collection options can be dictated by the refuse collection system in place. That is, if residents are responsible for bringing their own garbage to the curb, then they are apt to prefer their own individual blue boxes. Similarly, if they bring their garbage to a central collection bin, they would likely feel more comfortable with bringing their recyclables to a central area.

Medium and Large Buildings

In multi-unit residential buildings there are a large number of considerations in the design of the internal collection of recyclables (moving recyclables from the individual residents' units to the central collection area) and the external collection of recyclables (the movement of recyclables from the central area to the collection vehicle). In all cases, the level of commitment and cooperation of the building managers and owners will reflect on the success of the program.

Internal Collection: The most popular type of internal collection program requires individual residents to bring their recyclables, often in a mini Blue Box or Blue Bag, to a central collection area. The resident is also required to sort out their recyclables according to what material goes into which collection container. Depending on space availability, the collection area can be located in the same area as garbage is collected (eg. chute room) or in an area where space allows for the placement of recycling containers (eg. back alley, parking garage, storage room). In rare instances, the building superintendent will take on the responsibility of bringing the residents' recyclables to the central collection point.

The provision of in-house collection containers, such as bags or boxes is not essential to a multi-unit program. However, the City of Toronto found a 39% increase in participation after distribution of Blue Bags to their apartment residents. If not possible to have a dedicated container, residents often use grocery bags or cardboard boxes to transport their materials to the central collection containers.

External Collection: When designing the central collection area, there are considerations such as the collection vehicle, type of containers, fire regulations, space availability and convenience to residents.

The collection vehicle is probably the most important design consideration. How a collection vehicle is compartmentalized will determine what materials are collected and how they are sorted at the central area. Its dimensions (width, height and turning radius) will impact on the placement of the containers or if the containers will have to be moved in order to be picked up by the vehicle. The vehicle's level of automation will reflect upon the type of central collection containers used.

There are a variety of collection containers available. The choice of containers will greatly depend upon the space limitations of the building, the number of residents serviced by the containers, and, as mentioned above, the collection vehicle. The most popular containers in use by multi-unit program are plastic carts, (@90 gallon capacity) often called toters, and bulk lift containers (2-3 cu. yd.).

Toters are wheeled semi-automatic collection carts with lids that can be serviced by rear packers, side loaders, or front-end loaders fitted with the appropriate lift kits. The container is tall and narrow so that it fits in limited floor space and can be moved easily. The bulk lift containers are lidded steel containers on canisters so they can be moved. They are serviceable by a front end loader.

Other containers that may be appropriate for centralized collection include garbage cans and steel drums (more applicable to small to mid-size buildings), Igloos and compartmentalized roll-off containers.

Fire regulations will also influence the choice of collection container. Fire codes may require that the containers have lids, are non-flammable, are accessible to fire fighting vehicles, and that their placement does not pose a fire or safety hazard.

Space limitations are likely to pose difficulty to many buildings. Because most buildings were not designed for recycling, the set-up of a recycling program often requires the sacrifice of space used for another purpose, such as parking spaces and storage space.

The central collection area must be conveniently located to ensure maximum participation. Convenience requires that the area be in a regular path (eg. on the way to the car or laundry room) and be regarded as safe (well lit and secure). The location must also take into account the type of residents within the building. For example, if the building is primarily occupied by seniors or other people with physical limitations, their limitations must be incorporated into the program design to ensure participation.

Maintenance of the central collection area will also be a key factor in participation. The area should be maintained to ensure that the area is safe, aesthetically pleasing to the residents, not attracting pests and odour-free.

Promotion and Education

Promotion and education are essential to the development of a recycling program and to the program's on-going maintenance. This is never more true than for programs in multi-unit residences.

The greatest barrier to promotion and education efforts is the transitory nature of apartment residents. They are often single, young and highly mobile, such that the gains of a building's recycling program promotion and education are depleted whenever a tenant moves out. As a result, promotion and education efforts must be more intensive and frequent than efforts done for single-family residences.

There are two focus points for promotion and education: in the community (to encourage multi-family residences to set-up a recycling program) and within the building (to encourage correct participation in an existing program).

Community promotion of recycling is often geared towards building owners and managers as they are key to the set-up of a program in their building. If they are not convinced that the program has real advantages, the program will never launch or survive. Some examples of community promotion and education are advertisements in newspapers, trade magazines and radio.

Promotion and education within the participating building is intended to increase awareness that the program exists, increase participation and improve the quality of the recyclables collected. Some forms of building promotion and education are:

- posters announcing the program launch;
- door hangers announcing the launch;
- kick-off meetings;
- brochures detailing the program and how to participate;
- in-home collection containers, such as Blue Bags, to act as an initial incentive and serve as a reminder;
- signage in the central collection area;
- signage on the central collection bins;
- contamination notices on the central bins, indicating any contamination noted during the last week;
- follow-up letters congratulating residents on their successes.

Promotion and education efforts must also take into account the nature of the residents. That is, efforts must take into consideration multi-lingualism and illiteracy.

Issues

There are a number of issues that must be addressed in the development of a multi-unit residential recycling program. The issues of contamination, measurability and the impact on private haulers are briefly discussed here.

Contamination: The contamination level of the recyclables is much higher in multi-unit, centrally-collected programs, than in curbside Blue Box programs. This contamination results in from cross contamination (participants inadvertently placing the materials in the wrong bin; eg. putting brown glass in the clear glass bin), improper participation (placing non-recyclable materials in the collection container; eg. placing plastic toys in the plastic bottles. bin), and access to the bin by non-residents (people unaware or uncaring of the program's requirements).

Because the materials are generally collected in a bulk fashion, there is little opportunity to review the materials for contamination prior to having them emptied into the collection vehicle. This problem can be somewhat alleviated if there is on-site monitoring of the bins; that is, someone who will check the bins regularly and pull out any visible contamination.

Finding the source of the contamination is the more difficult problem. Because all residents in the building have access to the program, it can be impossible to determine the contamination culprit. The most effective means to tackle this issue is clear and regular communications with all residents.

Measurability: It is can be difficult to quantify the impact of multi-unit recycling programs. In larger buildings, determining participation level can be almost impossible. In small buildings, the addition of their recyclables to the curbside collection program makes it impossible to determine how much of the collected material comes from multi-unit versus single family homes.

Haulers: When a municipality begins to operate a service for collection of recyclables from multi-unit residences, they often tread on territory that has traditionally belonged to privately contracted haulers. Municipalities must be sensitive to the threat of potential loss of business to the private garbage haulers, as waste levels will decrease and the opportunities to provide a private recycling services are reduced.

Case Studies

Table B4-1 outlines a variety of multi-unit residential recycling programs and demonstrates the main types of collection programs.

Elements of a Successful Program

According to the recycling auditor in Faifax County in Virginia, the key elements to success are flexibility and communication. (Biocycle, Sept. 1993) This belief is reiterated in a number of apartment recycling guides. This section is an elaboration of the "flexibility and communication". theme -- Here are some key elements for the design and operation of a successful multi-unit residential recycling program:

Table B4-1
Examples of Multi-Unit Residential Recycling Programs

Program	Target Materials	Internal Collection	External Collection	Features
1. 3-chute system e.g. Robert Cooke Cooperative Lakeshore Village Etobicoke, ON	• metal cans • glass bottles and jars • plastic bottles • ONP • OMG • OTD	• residents collect materials in the 2-compartment storage unit under the kitchen sink. Paper materials are bagged or bundled separately • residents bring materials to chute rooms located on each floor and sort materials in blue boxes for fibres, metal and plastic containers, and glass • the materials are transferred from the chute room to the central collection area by a staff person or designated co-op member. The room has three chutes. Cans and plastic are sent down one chute. Fibres are sent down another. (The third chute is for residents to dispose of garbage.) Glass containers and OCC are put in a toter and wheeled to the central storage area on main floor.	• the central collection area features toters to hold the separated materials • toters must be moved a short distance to the curb to be collected by the municipality's hydraulic over-the-top collection vehicle. OCC collection is done by a privately contracted hauler.	• 3 hours of labour required per week • large chute rooms to accommodate boxes for recyclables • 3 chute system • space for storing recyclables has been designed into the kitchens of each unit • each unit is provided with a "Recyclist" storage container • based on a 16 week study, recovery is estimated to be approximately 32 kg/capita/year
2. Centralized Collection Area e.g. William Punnett Co-op Etobicoke, ON	• as above	• residents store material in their dwelling • residents are responsible for bringing these materials to the central collection area located outside the building	• the central collection area consists of 8 toters that are chained together • staff must unchain the containers on collection day • the municipality services these bins once/week with a hydraulic over-the-top collection vehicle	• based on a 16 week study, recovery is estimated to be approximately 33 kg/capita/year • minimal staff involvement in the program
3. Carousel System e.g. Barbertown Co-op Mississauga, ON (system being tested in a 12 storey building)	• ONP and OMG • mixed plastic containers and film • glass and metal containers	• residents store materials in the units. At their convenience, garbage and recyclables are brought to the chute room located on their floor • residents select a material option from the control panel (eg. the newspaper button) • after a few seconds the chute unlocks and the appropriate material can be placed in the chute. This process is repeated for each material, including garbage.	• the central collection location consists of six pie-shaped bins sitting on a carousel that rotate in response to the chute room control panels. Each bin is designed for a specific material (including garbage) • staff member is responsible for changing bins over when full and putting them out for collection (bins have castors) • the bins are serviced by vehicles with semi-automatic lift systems	• recovery is estimated to be approximately 33 kg/capita/year • carousel system can be installed as part of new building construction or retrofitted into an existing structure

Program	Target Materials	Internal Collection	External Collection	Features
4. Municipal Recycling program e.g. North Vancouver British Columbia	• metal cans • glass containers • HDPE and PET containers • ONP	• material stored in blue bags distributed by municipality • materials separated into well-signed toters and wooden newspaper boxes	• if required, building staff will move toters to an area accessible by the municipally-contracted side-loading collection vehicle. The toters are picked up and emptied by the lift mechanism. The ONP must be collected by hand using a dolly.	• each unit produces an estimated 20 lbs of recyclables per month
5. Municipal Recycling Program e.g. Guelph, ON	• ONP • metal containers • glass containers • rigid plastic containers		• 2 stream collection in colour-coded plastic toters (ONP in one, commingled containers in the other) • pick-up done by top loading Labrie/Amertec/Walinga vehicles	
6. Municipal Recycling Program e.g. Midland, ON	• ONP • glass containers • metal containers		• 3 stream collection in bins build by apartment owners • picked up by one ton flat bed truck equipped with metal cages	
7. Municipal Recycling Program Waterloo Region	• ONP • OCC • OTD • PET • metal containers • glass containers	• one blue box per unit is given to buildings with 10 units or less by the Region • blue bags are given on request to Cambridge and Kitchener residents by the Region • the City of Waterloo gives mini-blue boxes to residents	• blue plastic toters are used for 2 stream collection (fibres and containers) • OCC is bundled • top loading Frink/Walinga trucks pick up and empty toters; OCC is loaded manually	• one vehicle can service 70 buildings/8 hour day
8. Municipal Recycling Program e.g. East York	• ONP • glass containers • PET and HDPE bottles • metal cans		• 4 stream collection into Igloos or blue plastic toters • Igloos serviced by crane equipped truck • toters served by side loading Labrie/Walinga trucks	
9. Municipal Recycling Program e.g. City of Ottawa	• ONP and OMG • glass containers • PET • metal cans		• 5 stream collection • containers in 90-gal. Otto carts picked up n a Labrie truck • fibres in 2-cubic yard containers and picked up by a front end loader	• in January 1993, 20,000 households served, in December, 30,000 households served • recovery rate of 1,574 tonnes • gross cost: $854,000

- flexibility of design, communications and operation to take into account the space limitations of the buildings and the nature of the residents. Each building is unique;
- involvement of the building manager/owner, the residents and the collector in the design, implementation and operation of the program;
- personal commitment of the building owner /manager/recycling committee;
- convenience to the building manager and residents; and
- regular communication with and between all parties involved (municipality, manager, driver, residents)

Experience indicates that if the above factors are met, the quantity and quality of collected recyclables be maximized.

Estimates of Multi-family Recycling in GTA

There is limited data on recovery rates for recycling in multi-family buildings that could be readily applied to diversion estimates for the GTA. Single-family and multi-family capture rate data from the Capital Region District (Victoria, BC), Ottawa, North York, Mississauga and Etobicoke, shown in the table below, were used to determine a typical recovery rate for multi-family recycling as compared to single-family recycling.

Region	Single-family Rate (kg/hh/yr)	Multi-family Rate (kg/hh/yr)	Ratio MF/SF (%)
Victoria, BC	131	64	49
Ottawa, Ont.	141	52 - 79	37 - 56
GTA (Etobicoke, Mississauga, North York)	166	65 - 72	39 - 43

For systems for which a separate calculation was required, it was assumed that the multi-family households divert dry materials at 50% of the single-family household rate.

In the Wet/Dry System, diversion estimates assumed that, over time, multi-family households could divert household food waste at 50% of the single-family rate. This estimate may be somewhat optimistic, but it assumes that opportunities to participate in three stream source separation will be provided to at least 50% of multi-family households in each Region, and that reasonable participation levels can be achieved through extensive promotion and education

Greater effort is required by multi-family residents to compost, and data collected to date suggest that participation in neighbourhood and community based composting programs by multi-family residents is lower than in single family households. An estimate of 54 kg/hh/yr for multi-family composting of food waste in central units has been assumed for this study, based on the results of a study conducted in Barrie, Ontario, where multi-family households participated in a pilot project to compost food waste (Collins, 1994). With a strong promotion/education campaign, a participation rate of up to 50% of multi-family units in GTA is assumed with a diversion rate of 54 kg/yr per participating household. A discussion of multi-family composting is provided in Schedule C of the Service Technical Appendix.

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SCHEDULE B-5 — MANDATORY SOURCE SEPARATION (MSS) AND RECYCLING ORDINANCES

Introduction

In a program with mandatory source separation (MSS) of recyclables, residents are required to separate designated materials for recycling. MSS is a regulatory measure which can compel waste generators to separate waste requiring disposal from that which may be recovered for recycling, to provide for separate collection of materials. It provides an extra level of support to encourage participation. Source separation is described as an effective waste management tool to achieve segregation of recyclable and compostable materials from the waste stream, which can be applied to both the residential and IC&I sectors. (VHB Research And Consulting, 1993) Source separation regulatory measures provide an impetus for citizens to recycle designated materials (ILSR, 1991). In many cases, an MSS program will be linked with other regulatory measures such as material collection and/or disposal bans.

Although mandatory source separation programs appear to be a promising tool in waste reduction, there is not yet a great deal of data that specifically addresses waste reduction achievements that can be attributed to the requirement; however, studies are beginning to address the correlation between participation rates in recycling programs and mandatory source separation/recycling legislation. During the preliminary stages of a study prepared by the Institute for Local Self-Reliance (1993), it was determined that of 45 municipal recycling programs operating throughout the United States, the majority (80%) of those that had achieved less than 25% materials recovery level were voluntary in nature (ILSR, 1993).

In order to implement a successful MSS, a number of elements should be put in place including:

- provision of an alternate means of diversion such as curbside collection, drop-off centres, etc;
- program monitoring (e.g. random container inspection, monitoring garbage by haulers, monitoring at the landfill, etc.)
- program enforcement and identification of consequences for violations (e.g. by the collector of recyclables/garbage, by the inspector performing the monitoring function, etc). Enforcement techniques include leaving garbage behind with an explanation, warnings, and fines.

Experience in North American Jurisdictions

MSS has been used as a method to increase participation rates and material recovery rates in Canadian, American and European jurisdictions. According to Steve Shrybman (1989), MSS programs operating in Ontario and Europe can substantially increase participation rates to between 90% and 95%. The following case studies highlight recycling programs that have introduced MSS programs and have reported considerable success with their programs.

Rhode Island Residential MSS program

Rhode Island's source separation program has achieved a reported 90% participation rate. Recovery efficiency rates were estimated based on information received from three jurisdictions (Cranston, East Greenwich and West Warwick) which are as follows:

newspaper	85%
glass containers	45%
aluminum cans	50%
PET and HDPE	75%
organics	95%

The low recovery rate for aluminum cans is attributed to the buy-back program operating in the state (SRMG, 1993).

South-West Oxford Township, Zorra and Midland Residential MSS programs

The Ontario municipalities of South-West Oxford, Zorra and Midland were among the first Ontario municipalities to implement MSS programs. The supporting bylaws stipulated source separation of designated materials and provided enforcement authority through fines and refuse rejection. These municipalities were entitled to refuse to collect non source separated garbage and to issue fines of $2000 for Zorra and $100 for Midland. Since the MSS program, these municipalities reported participation rates in excess of 90% and that no refuse collection needed to be terminated (Shrybman, 1989).

Region of Halton, Ontario

The Region of Halton (102,233 households) has a mandatory ordinance in place that requires residents to separate certain recyclables (include ONP, glass, cans, plastic soft drink containers) from other garbage. The MSS ordinance is also linked with a landfill ban for these materials.

When the ordinance was first implemented, a number of enforcement measures were put in place including temporary recycling inspectors that patrolled the streets, and fluorescent stickers left on trash containers of non-separated garbage in Oakville. Non-compliance could be charged with a maximum fine of $2,000.

After implementing the ordinance, the Region reported improved diversion rates from 19% to 23%.

Other Contributing Factors

Apart from mandatory source separation legislation, there are other factors that may directly or indirectly attribute to high participation rates and recovery rates. Some of these factors include: the frequency of collection, educational and promotional programs, community support and involvement, and supporting enforcement procedures. For example, in the community of Babylon, New York, a MSS program has only achieved 63% participation rate; however, this program is not supported by an enforcement program and has a bi-weekly collection schedule (ILSR, 1991). On the other hand, Hamburg, New York, boasts a 98% participation rate which has been attributed to a highly publicized educational program (Shrybman, 1989) and a weekly collection program (ILSR, 1991). The Region of Halton, has achieved an over 90% participation rate and also has a MSS program; however, according to Art Mercer (Region of Halton), participation rates exceeded 85% prior to the MSS legislation which were attributed to high level of community support and involvement (Mercer, 1992).

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SCHEDULE B-6 — PRODUCT STEWARDSHIP

Introduction

Product stewardship refers to the principle by which the manufacturers and consumers of products and packages are responsible for the costs of managing those products and packages throughout their entire life cycle. The principle of product stewardship is an evolving concept. Most programs and policies designed to implement product stewardship are relatively new. Many of the specific responsibilities and costs associated with products are not yet fully defined or understood. However, a variety of different forms of product stewardship programs have been implemented or proposed.

A properly designed product stewardship program should incorporate the following elements:

- help drive source reduction as manufacturers modify product and package designs and as consumers respond to the incorporation of waste management costs into product prices;
- encourage design for responsibility;
- stimulate markets for recycled or reused materials;
- generate funds to offset the costs of proposed expansions in the waste diversion infrastructure.

There are four basic approaches to implementing a product stewardship program:

- deposit/refund systems;
- product/packaging taxes;
- industry funded and self-managed systems with backdrop regulations;
- mandatory recycling requirements (i.e. minimum secondary content/utilization provisions).

A strategy for implementing a product stewardship program should put in place an appropriate mechanism for each sector or group of sectors within industry, until the entire range of packaging and short life products is covered by a product stewardship program of some kind. No single mechanism will suit all product/package categories.

Deposit/refund system

In these systems, a deposit is paid by the consumer at the point of purchase for designated products or packages. The deposit is refunded to the consumer when the product or package is returned to the point of sale or to a designated redemption centre. In this way, deposit/refund systems put in place a direct financial incentive to divert post-consumer items from landfill.

Variations to the basic deposit/refund model include partial refund systems, in which a portion of the deposit paid is retained in a public or private sector fund. Some systems require the payment of handling fees to retailers or other agents involved in the processing of materials, and in some cases unredeemed deposits are regulated and used for other related or unrelated purposes. The implementation of deposit/refund systems requires provincial involvement.

The appropriateness of a deposit/refund system for any particular product depends to a large extent on the nature of the product and the system through which it is distributed. Deposit/refunds may work well for products/packages that can be conveniently returned by

consumers to a point of sale, stored on site in a safe and environmentally sound manner, and recovered through "reverse distribution." It is unlikely that all packages and short life products could be placed on deposit without either making fundamental changes to current retail distribution systems, or developing an entirely new recovery infrastructure, based on a network of depots that must be operated and funded in parallel with other material recycling efforts.

Product / Packaging Taxes

Product / packaging taxes represent another approach. Included in this category are charges imposed on consumer products and packages. Product charges are generally designed to raise revenues for managing the specified products or packages as waste. They may also influence consumer purchasing decisions if the charges are visible and sufficiently high relative to prices. Ideally, charges would reflect the true cost of managing each item as waste. Product charges include:

- *revenue-based charges* (e.g. a gross receipts tax imposed as a percentage of the sales revenues from designated products/packages);
- *unit charges* (e.g. a flat fee imposed per unit of product/package sold);
- *variable unit charges* (e.g. fees that vary according to weight, volume, toxicity or some other indicator of potential impact on solid waste).

Product charges may be collected from consumers, retailers, wholesalers, distributors, producers and/or importers. It is possible to build exemptions into a product charge system (e.g. so that no fee is applied against items that are managed within a recycling or deposit/refund program). Product charges are generally considered within provincial jurisdiction.

Industry Funded and Self-Managed Systems

This type of approach could also be applied to all packages and short life products. A variety of these types of systems have been implemented to date, or at least proposed and debated. Implementation of these types of systems typically begin with the establishment of a backdrop regulation which includes:

- a definition of the manufacturers' responsibility and a list of the criteria which must be satisfied (e.g. establishment of defined waste management infrastructure, markets for recovered materials).

- clear identification of the products, packages and materials to be covered by manufacturers' responsibility, and the industries/sectors affected;

- a schedule of implementation, indicating the dates by which product stewardship programs for each category of products, packages or materials must be in place;

- authorization for the provincial government to impose regulatory and prescriptive measures should product stewardship programs fail. Backdrop measures could include the fourth basic product stewardship approach -- secondary content standards or minimum utilization requirements -- as well as product/packaging bans and design restrictions.

The affected industries are typically given sufficient scope to organize themselves in a manner which they feel will achieve the required product stewardship responsibilities

efficiently. In most cases to date, this has resulted in the formation of an industry-financed consortium to create the required waste management systems, contract out the management of a waste to other agents, fund an existing waste management system, or otherwise carry out the specified responsibilities.

The most comprehensive example of this type of system implemented to date is Germany's Duales System Deutchland (DSD), also known as the "Green Dot System". The system is described later in this chapter.

Mandatory Recycling Requirements

Mandatory recycling requirements can be expressed either as minimum content requirements, minimum utilization requirements, or minimum recovery rates.

Minimum content requirements establish an amount of recycled material that must be included by manufacturers in designated products or materials. The amount is usually expressed on a percentage basis (e.g. minimum 50% recycled content in newsprint). A time frame is usually established, whereby manufacturers are given a date before which the minimum content levels must be met or exceeded. Many recycled content laws currently in place provide a schedule of recycled content standards that increase over time to allow a gradual transition for the targeted industries.

Minimum utilization requirements are imposed on manufacturers, consumer product companies, importers or other responsible entities. These entities must utilize a specified amount of secondary material by a pre-determined date. Utilization may be achieved through a variety of means, including direct use in recycled content products, or contracting other parties to reuse or recycle the designated materials in some acceptable manner.

Utilization requirements are more flexible than minimum content requirements because they allow industries to use recovered materials in a range of end uses. (For example, post-consumer glass containers might be used as aggregate in road construction, incorporated into products such as reflective paint, or remanufactured back into new glass containers.)

Minimum content standards and minimum utilization requirements may be effective in ensuring markets in some cases, but may also limit flexibility in the development of waste diversion technologies and end market applications. These measures are more suited to a material-by-material approach, rather than a broad-based approach. These mechanisms should be incorporated into backdrop regulations for industry self-managed systems.

Minimum recovery rates can be established for specific materials, with the details and methods left to the producers of these materials.

Issues

A number of issues have emerged in attempts to implement product stewardship programs. These include:

- Product stewardship can be extended only to those parts of the solid waste stream that can be traced directly to specific manufacturers and distributors (i.e. used products and packages). All organic wastes are generally excluded.

- There is as yet no clear, widely accepted standard for calculating the full life-cycle costs, or even the waste management costs, of products and packages. As a result, most attempts at product stewardship through taxes or levies have relied upon

highly simplified methods for allocating costs among industry members (e.g. flat fees per unit of product sold). In many cases, these methods bear no direct relationship to actual waste management and environmental costs.

- Many of the product stewardship programs implemented and proposed to date require complex industry/government negotiations, often with no clear precedents.

Examples

Germany's "Green Dot" System

Germany's "Green Dot" system is perhaps the most widely discussed product stewardship model. The system is being put in place by a non-profit, industry-funded corporation -- Duales System Deutschland (DSD) -- as an alternative method of compliance to a regulation passed by the German government that would permit all packaging to be returned to retailers. DSD is a national materials collection organization that is now financing a national system for packaging recovery through curbside programs and depots. A packaging levy paid by manufacturers is used to fund DSD, and all packages for which the levy is paid are labelled with a "green dot". There is an incentive for retailers, who are strongly opposed to handling used packaging in their stores, to stock only those products with the green dot. The system includes a wide range of packaging materials, and material-specific recovery targets are being carefully monitored by government. DSD returns all materials to industry at a price of zero.

A number of problems have arisen in the "green dot" program including increasingly high sorting costs, and a limited manufacturing capacity to absorb the plastic packaging that has been collected. The result has been that a large amount of plastics collected by the DSD has been exported and landfilled outside of Germany.

Eco-Emballage, France

France's Eco-Emballage program, now in early stages of development, borrows from both the German Green Dot and Ontario OMMRI system. It is an industry consortium that will be funded from fees levied against packaging (which will be identified with a green dot, as in Germany). It will participate in a shared industry/government funding arrangement, in which Eco-Emballage will pay for that portion of recycling costs which exceeds the average cost of incineration with energy recovery.

Canadian Packaging Stewardship Initiative (CIPSI)

The proposed Canadian Packaging Stewardship Model, supported by a wide range of product manufacturers and retailers proposes the formation of a national industry funding organization (IFO). It also proposes a system of industry levies in which each industry member will pay in proportion to the actual costs of managing their packages. Unlike the existing systems mentioned above, this model would also incorporate explicit market development incentives, including a rebate paid to industry members who are able to utilize secondary packaging. Investments will also be made to research new technologies to expand or establish new markets and financial incentives for corporations to increase their use of recovered materials and to re-design their packaging materials.

The model also proposes backdrop regulations in each province that would require all brand owners to either join the IFO or establish a product stewardship program of their own. The

responsibility for managing packaging under CIPSI will be shared between the producer, the distributor and the consumer.

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SCHEDULE B-7 — COLLECTION SYSTEM DESIGN DECISIONS

Collection Program Design Decisions

The selection of collection equipment for a curbside program depends on a number of program design considerations which are related to the separation and storage activities at the household, curbside setout and collection details, and processing and marketing arrangements. Whether starting or expanding a program, the following issues must be resolved in the collection program design:

- What materials will be collected in the program? How many households will be served?
- What preparation steps will the householder be requested to perform? (e.g. rinse jars, remove labels, etc.). How will materials be set out at the curb? (e.g. flatten OCC and bundle, ONP in a bag, etc.)
- What type of household container(s) will be used? What size?
- What will be the frequency of collection?
- What degree of commingling will be on the truck?
- How will the materials be processed?

Many of these issues are interrelated and will have a direct impact on the type of collection truck required. For example, the frequency of collection and the number of materials collected will affect the size and perhaps the type of container, and the degree of commingling on the truck will impact the efficiency of the collection operation, the type of truck, and the complexity of the processing operation.

The following section provides more detailed information on a number of the issues mentioned above.

Convenience

Experience has shown that material recovery is maximized when the program is made convenient for the householder. A recycling program will require that residents separate recyclables from trash, prepare recyclables, store them until collection day, and set them out on the curb in a specific way. By complicating or adding to these steps, convenience drops, and some residents may decide they no longer wish to participate in the program -- the result is a drop in program participation and material recovery.

Household containers

In general, the basic types of household containers used today are: rectangular boxes (the "Blue Box"), roll-out carts, and bags. Convenience plays an important part in container selection, since the number of containers used and their size may have an impact on program participation.

The "Blue Box" is most commonly used in Ontario. The Blue Box offers a powerful publicity tool for the community and a source of recognition for participants. Some disadvantages of the Blue Box is the amount of space required for storage. Also, some argue that residents are likely to set out their blue bins when they are slightly more than half full

instead of completely full -- this decreases the collection efficiency, since the hauler must stop to collect a half empty bin of recyclables. However, aggressive promotion and education efforts are teaching residents to set out their Blue Boxes only when full.

Roll-out carts are now being used in some curbside programs that collect a broad range of materials. Carts typically range in size from 30 to 90 gallon, are convenient to roll to the curb, and are normally lifted and unloaded by an hydraulic mechanism on the collection vehicle. The 90 gallon carts are more commonly used for multi-family programs. Some residents find the cart storage poses a problem if space is limited or if multiple carts are required. Carts are also relatively expensive (range from $55-$75 for a 30 gallon container and $90-$120 for a 90 gallon container) and do not allow further sorting to occur at the curb.

A growing number of communities are testing bag systems for the collection of recyclables. The bags are similar to plastic garbage bags, however, many programs distribute specially coloured bags (blue, green, etc.) printed with recycling logos. The primary advantage of bag systems is that the bags can be collected using the same truck as garbage, often at the same time, potentially reducing system collection costs. Bags can also hold more than a bin. Participants may also choose to set out bags less frequently than a bin, since the bag can be tied and set aside until it is full. This increases the efficiency of collection, since the hauler decreases the number of stops on a route (however, *full* bags of recyclables are collected). Some disadvantages include bags ripping, additional costs of bag-opening at the MRF, and a higher potential for contamination (materials cannot easily be screened during collection at the curb). The most critical aspect of a bag program is finding an efficient, cost-effective, sustainable, and convenient means of bag distribution to residents -- much coordination is required to make sure local retailers have a supply of recycling bags.

Level of Commingling on the Truck

Whether to collect recyclable materials commingled or segregated is a key issue because of the implications to overall program design and especially collection efficiency. The level of commingling during collection will also impact the processing design.

The degree to which recyclables are mixed in the collection vehicle can be defined by the following three main options (also, see Overview-- Recycling System Option, Figure B7.1 which shows the interrelationships between collection and processing).

1. *Fully commingled.* Recyclables are set out together and loaded into the collection vehicle unsorted (fibre and container materials together). This option provides maximum collection efficiency, due to reduced driver sorting time (no segregation at the truck). Another advantage is that there is less concern about truck compartments filling at different rates. The implication of this system is that a maximum level of sorting is required at the processing facility, thereby increasing processing costs. There is also a concern about increasing contamination levels (especially ONP and glass). For these reasons, fully commingled systems are not very common in North America.

2. *Partially commingled.* At a minimum, the collection vehicle is divided into at least two compartments, usually to separate fibre materials from the remaining container materials. A truck with more than two compartments may have further separation of materials (e.g. plastics combined with glass, or cans combined with plastics). This system will require less processing at the processing facility.

3. *Fully segregated.* All materials are placed in their own compartment in the collection vehicle. All plastic or all colours of glass may be commingled but

Figure B7.1
Recycling System Options

COLLECTION		PROCESSING	
Level of Sorting	**Type of Collection**	**Level of Processing**	**Implication**
FEW SORTS	• Fully Commingled (commonly curbside collection)	**MAXIMUM**	— extensive separation — $$ — increases contamination levels (esp ONP and glass)
	• Partially Commingled (commonly curbside - sometimes depot)		— basic sorting and processing equipment required — some consolidation
MANY SORTS	• Segregated (commonly depot collection – sometimes curbside)	**MINIMUM**	— minimal separation required — usually only densification — sometimes shipped directly to market or broker

different materials are not mixed together. This option is most commonly used in depot collection programs. In a curbside program, as more and more materials are added to the sorting requirement, the more the likelihood that one of the compartments will fill earlier than the others (the truck will then need to return to the MRF -- inefficient use of truck capacity). Separation requirements at the processing facility are minimal. This system also often results in materials of higher quality, since they have never been commingled.

Partially commingled or fully segregated collection typically results in slower collection times per stop than commingled collection. Obviously, the more sorting done at the truck, the more time spent per stop (stop time per household increases by about 5 seconds with each additional material sort that the driver does at the truck). Therefore, as collection crews sort recyclables into more and more categories, the number of stops per hour should decline.

As the level of commingling on the truck increases, processing costs decrease (level of separation required at the processing facility is decreased). Each community will need to compare the collection sorting costs versus processing sorting costs.

Selection of Curbside Collection Vehicles

Key criteria which need to be considered in selecting the appropriate collection vehicle include:

- *Capacity*. The desired capacity of a truck depends on the quantity and volume of materials which will be collected during a given period. Capacity indirectly impacts collection efficiency, in that fewer trips are required to unload material. Generally, the larger the capacity, the more efficient the collection.

- *Vehicle dimensions*. The length, width and height of a vehicle. Loading a longer vehicle will take more time than a regular-length truck. Vehicles with a low loading height are more efficient to load.

- *Flexibility*. The level of flexibility to adapt to changes in material types collected or variations in material volumes brought about by seasonal fluctuations. This criteria is important as a recycling program evolves.

- *Design Features*. The primary consideration in selecting a vehicle is collection efficiency. Some specific factors that affect collection efficiency and have not yet been mentioned include:

  — right-hand drive, stepout cab. If the driver also loads material, a right-hand drive cab with a low-profile curbside stepout design minimizes the time it takes for the driver to exit and enter the vehicle during the collection.
  — hydraulic loading. Many collection vehicles now have hydraulic lifting devices at the side, front, or rear to assist in loading recyclables into the truck. In many collection operations, hydraulic loading mechanisms have increased collection efficiency by about 15 percent.

  The most common recycling vehicle used today is a closed-body recycling truck operated by one person. The trucks have dual drive, and are hydraulically loaded. Trucks include a number of compartments.

- *Cost*. Dedicated collection vehicles generally range in price from about $45,000 to $110,000, depending on the generic type of vehicle and its design features. At

least 50% of the annual operating cost of a one-person-operated vehicle is typically made up of salary and benefits. (Obviously, as the crew size increases, this percentage grows). This is why many recycling vehicle designers are providing efficient material collection by using a single driver. Recycling operators must review the impact of both the capital and operating costs of the vehicle. For example, the capital cost of incorporating right-hand drive capability with stepout to the curb may be high, however, it will be offset by a reduction in operating cost resulting from the increase in operator efficiency.

Program Efficiency

In an effort to design a collection system which is cost-effective and efficient, a number of communities are using one vehicle to collect both garbage and recyclables. This type of collection system is called "co-collection" and is a relatively recent development in the recycling field. The main advantage of this system is that it is able to integrate garbage, recycling and composting collection (in one truck), therefore reducing collection costs considerably.

There are two different methods of co-collection. The most common approach is for residents to commingle recyclables in one bag and set the bag(s) out at curbside with their garbage. Haulers collect the bags of recyclables and garbage in the same truck. The most significant cost advantage of the bag collection is the use of existing collection vehicles. However, there are added handling and processing costs because bags of recyclables need to be separated from bags of garbage. Also, the bags of recyclables must be "debagged" and sorted. Glass breakage can be a problem since recyclables are commingled in bags and collected with garbage -- this may contribute to contamination rates.

In the second approach, residents set out their recyclables in rigid containers with their bags of garbage. The material is collected in a specially designed "co-collection" vehicle, or in vehicles that have been retrofitted with recycling bins or trailers. This method involves an immediate capital investment for the containers and the collection vehicle, however it avoids double handling of refuse, and reduces the amount of processing required for the recyclables.

A number of vehicle manufactures have developed specialized co-collection vehicles with multi-compartments. The earlier models had two compartments either horizontally or vertically split. More recently, manufacturers have developed vehicles with two to five compartments to source separate recyclables (e.g. fibres, glass, and containers). Vehicles with fixed compartments may be subject to "cubing out" problems -- this occurs when one compartment fills up at a faster rate than the others. When this happens, the vehicle must be unloaded before it can continue collecting material.

Although Ontario experience with co-collection systems is limited, the availability of innovative dual compartment collection vehicles and the need to find more cost-effective ways to run recycling programs has led many municipalities to rethink the way that they now collect recyclables and refuse.

A number of co-collection case studies are included in Table B7.1.

Table B7.1

Summary of Selected Co-Collection Programs

Program	Description	Results
Chicago, Illinois • pilot blue bag co-collection program Source: City of North York Curbside Collection Options. RIS. 1994	• pilot program conducted during spring 1991 • serving 2,800 hhlds • recyclables collected in blue bags supplied by the city -- residents requested to segregate fibres (ONP and OMG) in bags within the blue bags to help sorting • yard waste also collected in separate bags • regular packer truck used to collect blue bags, garbage bags and yard waste bags • recyclable materials collected include ONP, OMG, glass, metal containers, HDPE, LDPE and other plastic containers	• about 9% of the blue bags were not recovered from the garbage because of bag breakage • contaminants and residue comprised about 11% of the contents of the blue bags that were recovered • monthly participation rate about 80% -- convenience cited as positive attribute • many criticisms of the pilot including poor quality of recovered material (particularly as a result of contamination by broken glass) • City projected a savings of about $29 million/year over 10 years compared to the costs of a blue box • recovery about 82 kg/hhld/yr

Program	Description	Results
Omaha, Nebraska • full-scale blue bag co-collection program Source: Municipal 3Rs Infrastructure: A Reference Guide. International Case Studies. Ministry of Environment and Energy, 1994.	• 100,000 hhlds served • program fully operational by 1990 • garbage and recyclables placed into same compartment of compactor trucks -- existing collection vehicles used (no modifications required) • one person vehicle • bags containing recyclables are sorted from refuse at the processing facility • recyclables collected include ONP, glass, ferrous, aluminum, coloured and clear HDPE, green and clear PET • residents required to separate ONP and place in blue bag -- remaining commingled materials placed in separate bag • bags purchased by residents at grocery store	• some glass breakage occurs when materials are compacted on truck • 16% of blue bag material rejected as non-recyclable • co-collection and haulage costs are about $44/tonne; receipt of co-collected material and separation of blue bags is about $8/tonne; processing of recyclables is $134/tonne • monthly participation rate is 52-54% • recovery about 55 kg/hhld/yr
Houston, Texas • pilot blue bag co-collection Source: City of North York Curbside Collection Options. RIS. 1994	• participants fully commingled recyclables in blue bag • 19,000 hhlds served • blue bags and garbage bags collected in same compartment of truck • materials collected include ONP, ferrous and aluminum containers, PET, HDPE rigid	• when bags were originally supplied to residents, participation rate was from 30-40% • once residents were required to purchase own bags, participation dropped to about 15-20% (attributed to cost and inconvenience) • about 16% of bags were rejected during processing

Program	Description	Results
Lemsterland, Netherlands • full-scale co-collection program with specialized truck and containers	• about 4,526 hhlds served -- 5% high-rise and multi-family • each household has 2 split 63 gallon carts • 26 cubic yard truck is used - horizontally split. Both compartments have variable compaction ability • week one -- organics and garbage are collected; week two- one compartment used for fibres, the other for commingled containers	• 900 to 1,400 carts can be collected in 8 hours • achieve about 65% diversion

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SCHEDULE B-8 — FUTURE WASTE GENERATION AND COMPOSITION

Role of Future Waste Generation and Composition in this Study

This section presents information about potential future changes to waste generation and composition in both the residential and IC&I sectors. Despite the growing interest in future waste generation and composition, no definitive research has been conducted that investigates the effect of future lifestyle, economic, and technological trends on product design, use, and disposal. There is an inconsistency in the information and analysis that reflects a wide range of opinions on the topic. Consequently, this section is presented as a description of the current state of debate related to potential effects of future trends on society and its waste stream.

Future waste generation and composition is a critical factor in planning future waste management and diversion programs and facilities. These estimates have assumed that future waste generation will be similar to the generation (expressed as tonnes/capita and tonnes/employee) experienced in the last six to seven years. It has also been assumed that some source reduction of these generation rates will occur over time.

For the short term, evidence suggests that waste generation rates in the residential sector and the IC&I sector will not vary considerably (as will be discussed in the next section on short term trends). Over the long term, however, the verdict is less consistent, particularly as source reduction may potentially assume a more prominent role.

Future waste composition is more difficult to predict with any degree of confidence, as it depends on a large number of factors, such as changes in lifestyle patterns, economic trends, and technological transformations. Over the next 20-25 years, future residential waste composition will vary depending on how our attitudes and behaviours towards consumption change as a reflection of changes in lifestyle habits and technology. Similarly, future IC&I waste composition will depend on how our commercial and industrial base changes over the next 20-25 years.

In the short term, consumption patterns are assumed to remain fairly constant. While there may be greater substitution in materials used in the production of products (i.e. paper made from hemp and straw rather than trees), this shift will not significantly impact on the composition of the waste stream. The long term impact of developing the "information highway" and other economic and technological trends can only be speculated upon. This is done in the following sections.

Because of the uncertainty associated with future waste composition estimates, the GTA 3Rs study has been carried out assuming that generated waste composition will remain similar to that which is currently experienced. This is a conservative approach, that is considered more reliable and defensible than assuming a waste composition trend based on assumptions which may or may not occur. This approach is similar to that used by Sound Resource Management Group in their review of the November 1993 Draft GTA 3Rs Analysis.

Approach to Discussion of Future Trends

Predicting future trends for waste generation and composition relies on predicting future economic, technological, social and lifestyle trends. For the long term especially, this is subjective and mostly theoretical. Research conducted in this area has revealed a broad range of often diverging and contradicting opinions about long term trends. Short term trends can be predicted with more accuracy however, because their beginnings are often rooted in past and present economic and lifestyle patterns.

For this reason, future trends are discussed in two separate sections of text, namely the short term, which covers the years 1995 to 2000, and the long term trends, which cover the years 2000 to 2016. This information is provided for information only, and highlights significant lifestyle/consumer changes that are considered likely to affect waste generation and disposal.

Short Term Trends: 1995 to 2000

The availability of literature featuring short and long term trends in waste generation and composition is scarce. Information on short term trends has been derived mostly from U.S. sources. These sources are used as a guide since past and present waste composition and generation rates have remained relatively similar between the United States and Canada.

Residential Sector

The 1992 report *Characterization of Municipal Solid Waste in the United States*, prepared by Franklin Associates for the Environmental Protection Agency, indicated that per capita waste generation in the United States increased from 2.7 lbs per person per day in 1960 to 4.3 lbs per person per day in 1990. By the year 2000, it predicts that the waste generation rate will increase to 4.5 lbs per person per day. This indicates that generation of solid waste is still anticipated to increase by a small amount to the year 2000. This increase is relatively insignificant compared with the increase experienced in the last 30 years. Overall, the Franklin report projects that municipal solid waste generation will increase at a rate of 1.3% annually between 1990 and 2000, compared with the annual increase of 2.8% experienced between 1980 and 1990.

Other documents indirectly support this trend of minimal changes in generation rates over the short term. Advertising spending is considered both a reflection and a stimulus for consumerism, according to the Worldwatch Institute (1994). Since the 1950s, per capita expenditures on advertising in the United States has increased from $200 per person in 1950 to $468 per person in 1990. As North Americans reach a potential saturation point of advertising and consumerism, corporations have begun to focus on new, untapped sources such as the Asian market in the belief that "Asians will be the consumers of the 1990s" (Naisbitt & Aburdene, 1990, pg 28).

The Franklin report projects no major changes in waste composition to the year 2000. Paper and paperboard are projected to be the dominant materials in the municipal waste stream (MSW) and will make up an estimated 38% of total waste generated. Part of the rise in paper use can be attributed to globalization. Increasingly, the public enjoys access to more publications from around the world such as magazines, newspapers, and books than ever before, according to the authors of *Megatrends 2000* (Naisbitt & Aburdene, 1990).

The use of paper and paperboard as well as plastics, wood and some miscellaneous materials is expected to increase faster than the population, while the use of glass and metals are projected to increase more slowly than the population. Food wastes are projected to show no increase in generation, while yard trimmings are expected to decline as a percentage of the waste stream.

The Franklin report also predicts an increase in the consumption of durable goods over the next decade. This trend, if true, will have a more significant impact in the waste stream over the long term rather than the short term with the result being a gradual reduction in waste generation rates over time. The report sites the following trends as evidence: substitution of lighter materials (such as aluminum and plastics) for heavier steel; manufacturing of tires with longer life spans; and manufacturing of cars with extended rust proof guarantees. As North Americans move towards a higher wage economy (Beck, 1992; Naisbitt & Aburdene, 1990), they can potentially afford the higher capital investments of durable goods. Also, as more companies begin to incorporate the concepts of full cost accounting and life cycle

analysis into design and manufacturing procedures, the effect should favour durability and multiple use over single use and disposal.

In the short term, however, the consumption pattern trends do not favour a rapid movement towards durable goods. Steel production remains on the decline (Worldwatch Institute, 1994) and generation of containers and packaging is on the incline (Franklin Associates, 1992). For example, in the first half of the 1980s, per capita consumption of frozen prepared meals increased by over 30% in Western Europe, with a similar trend experienced in North America (Durning, 1991).

In Canada, the increase in packaging and containers should not be as prominent as in the United States due to changes expected to result from the National Packaging Protocol (NAPP) which requires a 50% reduction in packaging going to landfill by the year 2000. This national initiative may lead to a substantial reduction in the quantities of packaging waste both produced and disposed. Other product stewardship initiatives being developed in Canada may also help to shape future trends in packaging and the waste generation rates. There are no such initiatives being undertaken on a national or regional scale within the United States, upon which the Franklin observations are based.

Recent changes in shopping options and conservation programs may have a small effect on the waste stream. For example, over the past while, chains such as the Price Club and Aikenheads warehouse-like outlets have become popular. These chains promote bulk shopping by offering consumers large price discounts for no frill, buy-in-bulk shopping. Because customers buy large quantities, there is often less packaging associated with this shopping behaviour; however, no effort has been made to quantify the impacts on the waste stream. Whether this trend will continue over the long term is difficult to predict since these chains offer very limited selections of products to customers. This approach flies in the face of consumerism and choice, but is popular with many shoppers.

IC&I Sector

Recent voluntary and mandatory initiatives aimed at Canadian industries will impact on the generation of the IC&I waste stream. Initiatives, such as the Canadian Industry Product Stewardship Initiative (CIPSI), Canadian Buy Recycled Alliance (CBRA), and Ontario's 3Rs Regulations (waste audit and waste reduction plan legislation) encourage the IC&I sector to evaluate its waste generating habits and modify them to achieve a reduced waste stream.

Product stewardship models and initiatives are currently being considered in Ontario, which, if implemented would have a major impact on the amount of packaging waste generated and disposed. Packaging stewardship programs may result also in a shift to different packaging types depending on the financing structure of the program.

The Province of Ontario is the only Canadian province to legislate IC&I waste audits and waste reduction plans with the intent of making companies more aware of their waste generating habits and the savings to be made by reducing the waste stream. However, the State of Rhode Island has had similar legislation in place since 1988. Over half of the respondents of a recent Rhode Island survey questionnaire indicated that they have implemented source reduction and reuse activities, including double-sided photocopying, reusing shipping materials, replacing reusable mugs for disposable ones and purchasing items in bulk. In the survey, no attempt was made to estimate the effect on these practices on waste stream quantities or composition.

Programs introduced in the United States, such as the Green Lights Program and Ontario Hydro's energy conservation policy, may have the effect of reducing the number of incandescent lights used by the IC&I sectors. Incandescent and energy inefficient fluorescent lights are being gradually replaced by energy efficient fluorescent lighting which last at least

10 times longer than incandescent lights. The impact on the waste stream, at this point, is difficult to quantify, but is likely to be minor.

Currently, however, IC&I sector appears to be increasing its use of papers. The Worldwatch Institute attributes the rising global demand for office and printing paper to the steady growth of service industries and office employment and attributes the decline in demand for steel to increased use of other substitutes (1994).

For the time being, while the overall composition of the waste stream may not alter significantly in the short term, the composition of products may. In her book, *Shifting Gears*, Nuala Beck argues that there is no such thing as "scarcity of resources"; technological developments allow society to substitute one resource for another. Some recent trends include: the use of corn, seaweed, straw, hemp, sugar cane, and sugar beet cellulose as a substitute for trees in the manufacturing of paper (Isaacs, 1994), the production of car bumpers and other components from textile fibres (Beck, 1993), and shoes made from diaper waste, plastic milk jugs, and rubber tires (Globe and Mail, 1994).

Long Term Trends: 2000 to 2016

Predicting trends for the long term ultimately depends on predicting new technological developments and how they are to be tempered by social attitudes. A thirst for knowledge and technological advancement is an inherent and predictable part of human nature. How far people are likely to go in the quest for knowledge and the development of technological innovations remains unclear. How future technological innovations will impact on our lifestyles also remains unclear. In the book, *Futurehype: the Tyranny of Prophecy*, the author, Max Dublin, argues that "many of the most respectable prophecies today still fly in the face of common sense and/or common decency". With that statement in mind, this section explores long term trends that may potentially impact future generation rates and the composition of the waste stream.

The following discussion focusses on long-term trends affecting the residential and IC&I sectors. The residential sector features a discussion of consumerism and the effect of the information era on lifestyle trends, while the IC&I sector features a discussion about the new technology/information era, environmental accounting, and technology trends.

Residential Sector

Lifestyle Trends

Society appears to be on the edge of an era featuring the new global economy and the new 'information highway'. The potential impact on our lifestyle of these combined forces could be significant, although exact impacts are uncertain.

The information age and supporting technology (i.e. computers, VCR's, and cellular phones) has already had a profound effect on our lifestyles. Rather than invading people's sense of privacy and security, the authors of *Megatrends 2000* , claim that "computers, cellular phones, and fax machines empower individuals, rather than oppress them, as previously feared" (Naisbitt and Aburdene, 1990, pg 303).

The impact of information technology on our lifestyles has been significant. Computers are no longer associated with office environments, since they are found in increasing numbers of households. If predictions about the information highway prove correct, more householders will rely on computers and other telecommunication technology to purchase goods, pay bills, provide services and advice, and conduct business all without leaving the home.

Many futurists agree (Popcorn, 1991; Aburdene & Naisbitt, 1992) that at home shopping will also continue to grow. The verdict is out on whether at home shopping will result in more or less packaging. Faith Popcorn, author of *The Popcorn Report* argues that "packaging is over" since the frequent communications between consumer and manufacturer will eliminate the need for excessive packaging (Popcorn, 1991). Others appear less sure, particularly if mail/catalogue order continues as a popular at home shopping option (Aburdene & Naisbitt, 1992). With the rise of home shopping, it may be reasonable to expect a growth in the package delivery business, since goods will more likely be packaged individually rather than in bulk.

The Popcorn Report suggests development of other home shopping trends, including the prediction that "home delivery will become away of life, with holding tanks in the house for milk, soda, mineral water (all refrigerated), and bins for laundry soap and dog kibble, all delivered like home heating oil" (Popcorn, 1991).

Some proponents of the information era predict that the new supporting technologies will eliminate the need for paper and other materials. In a recent article, the Toronto Star reported that within a decade, newspapers could be replaced by light, portable, electronic tablets. News and information would be delivered anywhere in the world by fibre optic cable or satellite signal to computer memory cards contained within the tablet (Toronto Star, 1994).

In the short term however, the recent surge in information-based technologies has significantly increased our use of paper rather than reducing it. Revolutions in printing technologies, photocopiers, and fax machines have facilitated the rapid growth in paper consumption (Worldwatch Institute, 1994).

Consumerism

At the same time, access to greater amounts of information coupled with the movement towards a global economy should increase our demand for and access to goods and services. James Snider, a consumer-education expert writing in *The Futurist* (1992) points out that in 1800, a typical American had access to fewer than 300 products on sale in his or her hometown, while in 1993, a typical American living in a urban centre has access to more than a million consumer products. The typical GTA resident probably has access to a similar number of products.

Globalization has touched every country and culture in the world with one of the major impacts being the increased availability of products world wide. Coca-Cola has become a common household word in every corner of the earth; "go to the end of a rural road on any Third World continent, walk a day up a donkey trail to a hardscrabble village, and ask for a Coke. Odds are, you'll get one" (Durning, 1993). Similarly, products from every culture are now available in stores across North America.

The potential short term impact of the global economy on consumerism will be greater availability of products. Possibly cheaper, lower quality products will initially flood the market until developing countries begin to pay greater attention to social and environmental standards and people begin demanding a universally acceptable standard of living.

Food is another area where consumers are demanding greater choice and convenience. Faith Popcorn (1992) points out that consumption of pre-packaged foods is rising and that a Gallup Poll indicated that 86% of Americans who eat dinners at home during the week are eating pre-packaged foods or take-out foods. If they are not eating pre-packaged foods, then they appear to be eating out. One marketing survey determined that on average, people spend 46 cents of every food dollar on meals and snacks away from home. Convenience stores have also increased in number by 50% over the past decade (Durning, 1991). Faith Popcorn

suggests that based on expert opinion, take-out food spending will rise at three times the rate of total food spending.

Dr. Michael Jacobson, founder of the Centre for the Study of Consumerism, discussing the problem of consumerism in America, suggested conveniences become necessities, "we get addicted to them. The vast majority of Americans don't think they have sumptuous lifestyles; they think they're ordinary. But when you compare our lifestyle to that of a Third World country, or even to the United States 40 years ago, its astonishing. But we just take it as the norm. To understand, and then try to reverse things is very difficult." (Lapp, 1993, pg 32).

In his article, *Limiting Consumption, Toward a Sustainable Culture* (1991), Alan Durning examines the factors which have created a consumer society and discusses the challenges facing society in attempting to reverse the trend. Mr Durning identifies those factors that he feels must change to slowly alter the consumer-focused North American culture. These factors include:

- Advertising
  Access to young consumers must be limited and advertising practices in general must change in a more fundamental way;

- Shopping Culture
  Shopping malls promote increased consumerism. Laws in Britain and Europe limit hours when shops are open. The focus needs to move away from the shopping culture;

- Government Policies
  Prices must reflect the true cost of producing goods, to guide the market to less damaging forms of consumption;

- Weak Household and Community Economies
  At a personal level, commitment to non-material fulfillment is hard to sustain without the reinforcement of family, friends, and neighbours. Strong local institutions may be the only counterweight to vested interests.

Others have begun to suggest a new era of "deconsumption", "voluntary simplicity", and "vigilante consumer" (3SC Monitor, 1992; Durning, 1993; Popcorn, 1991). The forces behind this movement vary from a preoccupation with paying debts and getting value for the money, to a chosen lifestyle change toward simplicity. Some consumer trends support this move. For example, according to the Worldwatch Institute (1994), 1 in 3 people in North America now own a bike and the U.S. has 4 million bicycle commuters. The long term effect on the composition of the waste stream could be significant if the trend towards deconsumption and voluntary simplicity continues.

The upcoming generation will also play an important role in future waste generation trends. Today's children are much more aware of waste reduction and recycling than are the current generation of adults. The younger generation have grown up in an age where environmental concerns are higher profile, and environmental awareness is at an all time high in North America. It seems reasonable to assume that as these children grow up, they will maintain these attitudes and habits into adulthood, and teach these values to the next generations.

It is difficult to combine the diverse opinions presented above into one vision of the future that identified how waste generating habits will change. For this reason, the are presented for information only, and not interpreted for numerical analysis in this study.

IC&I Sector

Economic Trends

One of the major economic trends that will shape long term economic development well into the next century is globalization and the shift away from a local economy to a global one. The growth of rapid transportation and telecommunications have also helped thrust the world into an international economy. Since 1950, world trade has increased from $US 308 billion to $US 3.58 trillion in 1992 (Worldwatch Institute, 1994).

Globalization has led to the rapid economic growth in newly industrialized countries (NICs), many of which are located in the Pacific Rim. South and Latin American economies also are showing signs of tremendous growth, although are approximately a decade behind the countries of the Pacific Rim. Many of these countries are able to produce goods requiring high amounts of low skilled labour, much more cheaply than Western industrialized countries. As Western society moves towards an information based economy, there will be a shift in the location of traditional manufacturing firms from industrialized to non-industrialized countries. Developing countries are expected to move away from a strictly resource based economy to a more diversified one.

In her book, *Shifting Gears,* Nuala Beck traces the evolution of the North American economy from a commodity driven economy (1850-1918), to a manufacturing driven one (1918-1981) and finally to the technology based economy live in which we presently. The concern that developing countries are robbing the Canadian economy of traditional primary manufacturing and resource-based economies is a non-issue according to Ms Beck, since 70% of Canadians are already employed in the new economy (1993, pg. 43).

Ms. Beck suggests that the new economy features four sectors: computers & semiconductors; health & medical; communications & telecommunications, and instrumentation. Each sector is dominated by the following goods and services:

- Computers & Semiconductors are dominated by computer equipment, semiconductors, software, information services;
- Health & Medical include medical care & diagnostics, pharmaceuticals, surgical & medical instruments, surgical & medical supplies;
- Communications & Telecommunications include telecommunications services, guided missiles & space equipment, radio & microwave communications, and entertainment;
- Instrumentation includes optical instrument & lenses, engineering & scientific equipment, process controls, and environmental consulting & equipment.

Tied in with the new economy is the "information highway", which is envisioned as "a web of communication systems that will pump - for a price - huge quantities of text, sound, images and video into and out of homes, businesses, factories, hospitals, schools, and government offices" (Tapscott, 1994). A significant trend will be the continued emergence of a bi-polar service sector of highly rewarded educated management and professional service sector combined with a disproportionate numbers of workers in lower paying jobs, low income backgrounds, and under-educated workforce.

As evidence, Ms Beck reports for example that in Canada, from June 1989 to June 1992 the number of knowledge related jobs increased by 1.3 million where as the number of manufacturing production jobs decreased by 919,000 (Beck, 1993).

The evolution of the Canadian economy will help establish a symbiotic relationship with other emerging newly industrialized countries (NICs). As the NIC economies grow they will increase demand for high tech, knowledge-driven products and services. These will include engineering skills, specialized materials, computer and telecommunication equipment.

Another trend that may shape our economy and the types of products and services available is the incorporation of environmental accounting methods throughout the economy. To date, most monetary accounting practices, including the Gross National Product (GNP), ignore the environmental, and to a lesser extent, the social costs associated with goods and services. Advocates of environmental accounting are putting greater pressures on western governments to begin to quantify the effects of resource depletion, pollution, and other non-sustainable activities, and build this analysis into accounting practices (Kleiner, 1993). One such attempt is the development of the "Index of Sustainable Economic Welfare" (ISEW) system which quantifies the costs associated with resource depletion, environmental damage, and commuting costs along with wages and prices.

As environmental accounting practices become more widely accepted and adopted, they may greatly impact on the types of goods and services available influence those that appealing to the consumer. For example, durable products should be able to better compete with lower quality goods as prices come to reflect environmental and social effects associated with production.

Technology Trends

The growth of the information age and communications technologies will dominate technological development well into the next century. Computers will become even more prevalent in both industry and society in general. US consumers alone purchase 12.6 million computer annually, and this is expected to double by the year 2000 (Betts, 1994).

The IC&I sector is bombarded with more technology and "gadgets" than ever before creating and supporting a new consumer preference. For example, less than one decade after the fax machine was first introduced in the marketplace, it is estimated that Americans owned over 5 million fax machines in 1990. The number in 1994 is significantly higher (Naisbitt & Aburdene, 1990).

As we enter the information era, it is anticipated by many, including Bill Gates of Microsoft, that the next great boom will be in technology that enables different types of office equipment to communicate - i.e. the computer will be able to communicate with the photocopier. More sophisticated communication systems will unfold permitting to following to happen:

- rural doctors would be able to consult with urban specialists by sending high-resolution images of lab tests or X-rays;
- auto mechanics would consult with factory technicians on new models through interactive television;
- aerospace researchers thousands of miles apart could instantaneously view and discuss sophisticated wind-tunnel computer models (Tapscott, 1994).

Many futurists believe the electronic age will greatly reduce or even eliminate the amount the use of paper in the office (although, this has not been proven to date). Also, as certain resources continue to become more scarce and their prices increase, technologies will develop that use these resources more efficiently and reduce waste. This is already happening in a number of different industries, as outmoded methods are replaced with state of the art equipment which operates more efficiently.

The "high-tech" age is predicted to produce more computer and other electronics related waste. In a study conducted by members of Carnegie Mellon University, continued consumer demand within the United States for faster and fancier computers is expected to send 150 million personal computers to landfill by the year 2005 (Betts, 1994). This type of equipment quickly becomes obsolete and is replaced. It cannot help but become a major element of the waste stream unless the parts can be reused or recycled. Reselling obsolete equipment to lesser developed countries is already a thriving new industry and will probably continue to grow.

Also, making the transition to the visionary information era or information highway may result in major retrofitting of existing communication systems and infrastructures. Advanced telecommunication technologies require advanced fibre optic networks to support teleconferencing and internetworking systems. Increasingly, companies are likely to use advanced telecommunication technology to conduct business and visually communicate with others all over the world. Already urban centres are grappling with the challenge of retrofitting the existing infrastructure to accommodate the information era. With this change, waste is will be generated.

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SCHEDULE C

ON-SITE COMPOSTING

SCHEDULE C — ON-SITE COMPOSTING

Introduction

Composting refers to the process by which organic materials such as food, yard waste, wood, etc. are transformed into a stable end product referred to as compost or humus. Two primary types of composting are available. These include:

- On-site composting
  - — backyard composting
  - — vermicomposting
  - — multi-family/community composting
  - — mid-scale on-site; and
- Centralized composting
  - — centralized windrow (leaf and yard)
  - — centralized in-vessel.

This schedule focuses on on-site composting mechanisms that are utilized in residential and IC&I waste diversion systems.

Backyard Composting

Backyard composters allow householders to carry out this process on their own property, thus decreasing the quantity of waste that must be managed at the curb. Materials which are most commonly composted in backyard composters include yard waste, leaves, grass clippings, food waste, fruit and vegetable waste from the kitchen and, depending on the type of composter used, animal and dairy waste.

The backyard composting process generally requires placing wastes in a covered container, keeping the contents moist and well aerated. Watering, turning and adding dirt and some yard waste are required periodically. Various types of containers are available commercially or can be made with simple materials. Different designs facilitate aeration or limit possible problems. There are also digester/composters which employ an anaerobic process (absence of oxygen). Vermicomposters which use worms to break down organic waste are suitable for indoor use and for households such as apartments with limited space and low or zero generation of yard waste.

Although backyard composting is a relatively low-tech method for handling significant quantities of organic wastes, the potential impact of this method on reducing the waste stream to be disposed is now being recognized.

There are several advantages to backyard composting including the following:

- the amount of organic matter collected at the curbside is reduced, resulting in savings in transport, processing and disposal costs;
- there is a usable end product for participants which can decrease spending on fertilizers and soil conditioners;
- The process is low-tech and inexpensive in relation to other waste reduction and processing options;

- It presents a good opportunity for increasing public awareness and understanding of waste management issues;

- It offers a simple opportunity for individuals to get involved in waste management.

There are several factors to be considered in establishing backyard composting programs, including:

- the municipality's desired level of involvement in promotion, education, support, cost sharing and in distribution of composters;

- homeowner level of commitment to altering routines. Composting requires an individual to change waste management behaviour from putting waste in the garbage to actually source separating selected organic materials;

- the choice of composter, determined in part by the specific needs of the municipality and preferences of residents. For example, some composters only handle vegetable matter. Also, yard wastes may overwhelm composter capacity;

- the specific situation of multi-family dwellings. Greater effort may be required by residents and they may not benefit directly from use of the end product. A recent study of a demonstration project in Waterloo reported positive results, particularly with townhouse complexes. Suggestions for successful programs included a strong educational program, compatibility with existing garbage/recycling programs, flexibility, and a personalized approach, as multi-unit dwellings have varying populations and site characteristics.

Components of a Backyard Composting Program

Various options and success factors should be considered in implementing a backyard composting program. These include:

- selling or providing compost units. Some communities have provided compost units free of charge while others have charged a nominal fee. Participation in programs using either method has been high. From surveys it appears that people are prepared to pay for composters although some subsidy is required (Compost Management, 1992a, BioCycle, 1993, Maclaren, 1990, Composter's Journal, 1992, Kirkby, 1992);

- distributing compost units. Some communities have delivered units to residents while others have made the units available for collection. Both methods appear to have achieved high participation. The highest participation rates have been achieved in programs in which there was door-to-door distribution of compost units (Compost Management, 1992a, BioCycle, 1993, Maclaren, 1990, Composter's Journal, 1992, Kirkby, 1992);

- forcing increased use of composters by imposing bans or limitations on certain materials being sent to landfill. These could include bans on leaves or grass. Various communities, including Waterloo, Kitchener and Woolich have implemented such bans. Also, two communities in Halton have recently banned the disposal of grass in landfills;

- promoting backyard composting through various media such as "how-to" brochures, posters, public transit ads, newspaper ads, radio ads etc.;

- publishing written on-going education materials such as newsletters and brochures;

- providing training and outreach programs including the training of volunteers, permanent displays, periodic workshops and seminars. An example is the Master Composter Program in Toronto. This is funded partially by the Ontario Ministry of the Environment and Energy and coordinated by the Recycling Council of Ontario. It involves a comprehensive 40-hour training program for volunteers including instruction in composting theory, choice of composting bins, troubleshooting, use of finished compost, effective public promotion and education techniques. Volunteers agree to provide 40 hours of community extension for which they are provided training materials such as displays and literature;

- implementation of a grasscycling program which could be established in conjunction with a backyard composting program. This involves leaving grass clippings on the lawn. It is an environmentally sound method of handling some lawn waste in the backyard rather than requiring municipal collection and processing.

Experience with Backyard Composting Programs

Many districts and municipalities throughout Ontario have established backyard composting programs and have reported positive results (Compost Management, 1990, Compost Management, 1992a, BioCycle, 1993, Maclaren, 1990, Composter's Journal, 1992, RIS and H. Sutcliffe, 1993). A summary of information about backyard composting programs is presented in Table C.1. All GTA regions are actively involved in promoting and supporting the use of backyard composters.

All Regions have included the provision of free or subsidized compost or digester units. Some were distributed door-to-door while others were made available for pick-up.

Participation

Voluntary participation in backyard composting activities conventionally is considered to level at between 20 and 30 percent of households in Ontario communities. Milton currently has distributed composters to around 22% to 23% of households with minimal promotion and education (Pantonio, 1993). However, other municipalities have realized significantly higher participation rates (Centre & South Hastings Recycling Board, 1994, RIS and H. Sutcliffe. 1993, BioCycle, 1993). This is generally due to greater efforts at promotion and distribution. For example, Milton reports little or no promotion or education programs. In contrast, the Central and South Hastings Waste Management Board in 1992 had achieved between 65% and 70% householder uptake of backyard composters in its 15 municipalities with an aggressive door-to-door distribution program. A survey (involving inspection of composters) showed that 82% of composters were being used effectively, resulting in an effective 53% participation rate. It was estimated also that, conservatively, 85% of all residents (an additional 32%) had expressed willingness to compost (Centre & South Hastings Recycling Board, 1994, RIS and H. Sutcliffe. 1993, BioCycle, 1993, Kirkby, 1992).

In other pilot projects with a strong promotional component, acceptance of composters generally has been high, ranging from 75% in Durham (Compost Management Associates

Table C.1

Summary of Selected Backyard Composting Programmes

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Central and South Hastings, Ont.	full-scale		door-to-door sales at first - 6,000-8,000 subseq free door-to-door delivery - 17,000	65% to 70% of all households	17,000 (most recent campaign)	free and some for sale	$23-$37/tonne - over 10 years		132 to 215 kg/hhld/year 13%		YIMBY Program - final report (Centre & South Hastings Recycling Board, 1994) RCO Update - Oct/Nov 1992
Hamilton-Wentworth, Ont.	pilot	16,000 (60 hhlds sort & weigh)	52% pick-up, 42% delivered		16,000	$15.00			219 total (range 97 prev exp. - 279 new) 134 kitchen	Residents weighed	Gale, R., March, 1991
Metro Toronto, Ont.	full-scale	1989-1992	initially sold through tfr stns, subseq mobile distrib, plan door-to-door sale		Over 105000 (Feb, 1993) (2)	$10 + $5 deliv	$2.7million - $1.8million prov, $540,000 City for comp, $360,000 admin, $115,000 ed (1)		22,000 tonnes/yr - 200 kg/hshld/yr (Feb. 1993) (2)	Estimated from surveys - fractions of wastes, by type, composted (2)	1. BioCycle, Jan 1993 and, 2. Metro Works Dept - Home Comp Prgrm Partic Survey, Feb 1993
Milton, Ont.	pilot	1990 -	coupon in paper, pick-up	22-23%	1,900	$30/unit 1990 $17/unit 1992	all costs - MOEE and unit price			Not Available	Personal communication - Phil Pantonio, Milton
Mississauga, Ont.	pilot	1991-1992	door-to-door delivery	100%	3,701	free	50.00	110-120 kg food 40-70 kg yard		resident and controlled weighing	P&R, City of Mississauga Waste Minimization Demonstration Project, Reports, 1992-1994
Newcastle, Ont.	pilot	Aug. - Dec., 1989	door-to-door	n/a	60	free	$18.75/tonne		336 - total 228 - food	Residents weighed - surveyed	Compost Management, 1990
Ottawa, Ont.	full-scale	1991-1992	notices for pickup		gtr than 20,000	$15		$5,000 - half distrib, half advertizing		Not Available	BioCycle, Jan 1993
Pickering, Ont.	pilot	1991	Free, door-to-door	74%	831	free	$21.07/tonne (not incl. pjct monitoring)	$7.95/comp - pjct mon, data	244kg/comp/yr, 14.8%	Packer truck weight reduction	Compost Mgmt report, June 1992
Waterloo, Ont.	pilot	1991-1992	invitation on door to have delivered - subsidized cost	82% (2 - rev fr 84%) - either dig or comp, 77% - both, 79% still using (2)	246 (2)	free			352 - est from other studies, 30% of total residential (2)	Estimations from baseline data from other studies	1. Reg Waterloo, Res Waste Red Unit - Phase I, Oct 92 2. Phase II - Dec 1992
Alameda County, Cal	full	1990 -	free bins/wkshps		4000 (90/91)				340	survey of hshld estimates - not weighed	BioCycle - Apr 1992
Fairfax County, Virginia	pilot	1991	free distrib to workshop attendees							Not Available	BioCycle, Jan 1993
Glendale, Los Angeles	pilot	1991-	wkshp attendees rcvd free bin - other distribution		1,000	free			390kg/hhlds/yr	Not Available	Resource Recycling Apr, 1993
Marion County, Oregon	pilot	1992	At-cost sale through local stores		1,200 - six months	$10 - $50	$5-10,000 for progr			Not Available	BioCycle, Jan 1993
Sacramento, California	pilot	1992			2,000	free model and at-cost model	$10/comp and $20,000 for demo sites			Not Available	BioCycle, Jan 1993
Santa Monica, Cal	pilot	1992	wkshps (not clear)		1,125 - 15% of 7,500 homes	various sold with subsidy of $15				Not Available	Resource Recycling Apr, 1993
Seattle, Washington	full-scale	1989-1992	door-to-door delivery (init with trg)	estimated 70% of those distributed in use (2)	18,000 - end 1991, plan 7,200 - 1992	free	$40/bin (new plastic des), $US68.41/ton (with trg to 35%) (2)		estimated 118 kg/hhlds/yr yard waste (2)	Not Available	1. BioCycle, Jan 1993 2. News flyer - Seattle's Road to Recovery

Ltd., 1992a, 1993), to 84% in Waterloo (Waterloo, 1992). Even in those programs which charged a nominal fee (e.g. Waterloo, Metro Toronto), acceptance was high (Waterloo, 1992, Maclaren, 1990, Ferguson, 1993). In Pickering, there was initially only 9.5% acceptance when a brochure, delivered to homes, was used to promote interest in trying a backyard composter. However, two later campaigns with door-to-door promotion and delivery achieved significantly higher acceptance - 74%. Surveys of a pilot program in Mississauga showed that 75% to 80% of residents were effectively using composters (Proctor & Redfern, 1994).

Subsidizing the cost of composters to residents appears to encourage participation. 82% of respondents to an initial survey in Metro Toronto said they would not have purchased a composter if it had not been offered at a subsidized price (Maclaren, 1990), whereas in Pickering, where composters were provided free of charge, 80% of those surveyed said they would have been willing to pay for the composter at a subsidized price (Compost Management, 1992a).

The 1992 survey of residents in Metro Toronto, who had accepted a composter from the City over the previous three years, indicated a high on-going participation rate. Of those who responded to the survey (60%), 98% were still using their composter (Ferguson, 1993). In the Waterloo program, 82% of households in the pilot area accepted composters and after 11 months, 97% of those responding to the survey (36%), were still using them (Waterloo, 1992). In Pickering, after an initial acceptance of composters of 74% during the first year, participation had fallen to 78% of those accepting a unit (58% of the pilot households) (Compost Management, 1992a).

Waste Diversion Rates Achieved

From the survey of the YIMBY program in Centre and South Hastings, it was estimated that the average diversion of organic waste through backyard composting was in the range of 132 kg/hh/year to 215 kg/hh/year for all households with composters (Central and South Hastings Recycling Board, 1994). The pilot program in Mississauga demonstrated an annual diversion of organics of between 150 kg and 190 kg, between 110 kg and 120 kg of food waste and between 40 kg and 70 kg of yard waste (Proctor & Redfern, 1994).

Reported diversion rates vary from 3% to 32% of the residential waste stream in a sample of programs studied. In Mississauga test areas, it was estimated that 3% to 5% of the residential waste stream was being diverted by home composting from all households (Proctor & Redfern, 1994). The Central and South Hastings Waste Management Board estimates diversion in their program at 13% of residential solid waste (RSW) (BioCycle, 1993). Diversion varied from 244 kg per household per year in Pickering, estimated to represent approximately 15% diversion, to 336 kg per household per year in Newcastle, representing an estimated 32% of RSW (this was reported for one of the heavier times of the year for yard waste generation and may account for the higher diversion rate) (Compost Management, 1992a, 1992).

In Metro Toronto food (vegetable) wastes were reported to have the highest compost rates, above 80% throughout the four seasons. Garden wastes were the next highest, followed by lawn clippings and leaves (Maclaren, 1990).

Costs

The Ontario Ministry of the Environment and Energy will cover two thirds of the cost of composters/digesters and in some cases, will support promotion and education.

The costs of diverting waste through backyard composters vary, but are significantly lower than other waste diversion costs, on a $/tonne or $/household basis.

Cost estimates for an estimated home composting program in Mississauga were in the range of $45/tonne to $55/tonne (Proctor & Redfern, 1994). For the YIMBY program, cost estimates were in the range of $23/tonne to $37/tonne (Centre and South Hastings Recycling Board, 1994).

The Newcastle results indicated a waste diversion cost of $18.75/tonne. This is based on a ten-year amortization period for each composter and does not include government subsidies. Costs typically range from $15 to $50/unit when bought in bulk (RIS, Sutcliffe, 1993). In Pickering (Compost Management, 1992a), the waste diversion cost was estimated at $24.32/tonne. The latter was based on an overall cost of $59.35 per composter, of which 65% covered the cost of the composter itself, 22% covered administration, promotion and education and, 13% covered project monitoring (such extensive monitoring of pilot projects would not normally be incurred.)

The Metro Toronto program in 1992 cost a total of $2.7 million. 67% was borne by the Province, primarily for the cost of the composters. The rest was paid by Metro Toronto, consisting of the remaining 20% for composters and 13% for administration, of which 4% went to public education (BioCycle, 1993).

Issues

Some problems were experienced with use of the composters. These problems varied depending on composter type and geographic location. Surveys of residents have identified the following concerns and problems with backyard composters (Compost Management, 1992, 1992a, Waterloo, 1992, Ferguson, 1993, Maclaren, 1990):

- insects, particularly flies, in and around the composters;
- freezing in winter;
- size limitations;
- poorly-fitting and insecure lids;
- odours;
- scavenging animals.

It is not clear from surveys whether long-term participation would be affected by these concerns. Only 3% of participants surveyed in Metro Toronto cited these as reasons to stop using the compost units. Freezing and size limitation were noted to temporarily stop use (Maclaren, 1990).

Social Acceptability

Despite such problems, the vast majority of participants in backyard composting programs have been strongly supportive of the concept. All respondents to the Newcastle survey reported that they would recommend backyard composting to their neighbours (Compost Management, 1990).

Composting does not seem to be viewed as a nuisance. While 40% of respondents to the Metro Toronto survey reported having difficulty with tending the composting pile, few had difficulty with other composting tasks (Maclaren, 1990). In Newcastle, only one participant described composting as time-consuming or troublesome (Compost Management, 1990).

Many people had been composting prior to the launch of major demonstration projects and composting programs. In Toronto, it was found that about one third of those surveyed had been composting some of their organic wastes prior to receiving a composter from the City (Maclaren, 1990). In Pickering, 14% reported composting prior to the demonstration project (Compost Management, 1992a).

Most respondents to the Metro Toronto survey said they would continue to compost using their backyard composter even if curbside collection of food wastes was provided (Ferguson, 1993).

Residents with backyard composters still participate in separate collection of yard waste at the curbside. In Metro Toronto, 70% of respondents still put some yard waste out for collection in separate collection while 21% still put yard waste out with regular waste. This is thought to be affected to some extent by the size of composters, which cannot handle the quantity of yard wastes generated, and by yard wastes which are not suitable for the composters, requiring processing such as chipping (Ferguson, 1993).

One third to one half of participants surveyed in Newcastle found that using the composter tended to influence their buying habits to reflect greater conservation values (Compost Management, 1990).

Other On-Site Composting

Several new techniques are being piloted and utilized for on-site composting in multi-family residential and commercial settings. These projects are innovative and in early stages of development. The projects completed to date focus on maximizing participation in composting and identifying community benefits. Systematic studies of diversion have not yet been completed and estimates of diversion potential are inconclusive. There is a sense that participation in these programs does contribute an effective means of diverting further segments of residential and IC&I waste. However, it is difficult to efficiently monitor participation and diversion, and it has not yet been done.

A Report by The Recycling Council of Ontario presents an inventory of the types of programs presently in existence for multi-family and on-site IC&I composting. A summary of information that has been obtained from various studies of multi-family composting are presented in Tables C.2. to C.7 at the end of this chapter. The following presents an overview of findings from observation of multi-family residential and IC&I composting programs.

Vermicomposting

Vermicomposting (or worm composting) is an option for residents who may have limited space, or no access to an outdoor area for composting (e.g. apartment dwellers). Several worm composting units are presently available, however, worm composting has yet to receive strong public acceptance. The worm composter is versatile, in that it can be located outdoors in the summer, and must be brought in during the winter. It requires harvesting every three months and produces a high quality end product.

The Region of Peel conducted a study of vermicomposting by providing 250 units to multi-family residents. From this study, technical problems (i.e. with fruit flies and overloaded units) and problems with public acceptance were identified. Findings of this study showed that vermicomposting in multi-family units may have a relatively low waste diversion impact of only about 28.5 kg/hh/yr.

Balcony units (including vermicomposter Biobins and Envirocycle units) were distributed to approximately 100 units in Barrie, Ontario. Acceptance was generally good during initial promotion in May 1993, but has dropped since. Subsequent surveys show that there have been problems, and that while most composters are used, finished compost product has been minimal (Collins, 1994).

It is believed that technical problems with vermicomposting may be overcome through public education. However, public acceptance may remain an issue (Recycling Council of Ontario (RCO), 1993).

Multi-family/Community Composting

Several studies of multi-family composting have been carried out, particularly in Ontario. The largest co-ordinated study of multi-family units was a year-long project initiated in 1990. Findings of this study are presented in Table C.2. In addition to this large co-ordinated study, 4 independent projects were assessed. Findings of these projects are presented in Table C.3.

The Metro Toronto study involved providing twenty-five 3-bin units to multi-family residents in the Region. Bins were purchased at a cost of $150 per unit to the buildings. The objective of this study was to test the 3-bin system for use in multi-family dwellings.

The study sample included ten co-ops, one university building and one community agency, and two privately owned apartment buildings. The mix included high-rise, low-rise and town house buildings. The project was largely run by volunteers on the principle of community development. The projects were varied in terms of the level of encouragement and support provided to residents to encourage composting.

The Metro Toronto project was evaluated by organizers as a success in that residents did participate, achieving an unspecified level of waste diversion and increasing awareness. Some problems with composting odours, contamination and lack of participation were noted. Volunteers also noted concerns with labour involved in maintaining bins. Residents involved in the studies were asked to measure participation for six months, but few actually did so. Volunteers were hesitant to jeopardize composting participation by promoting this as a requirement.

A participation rate of 30% to 50% was reported for most bins utilized in the Metro Study. However, this must be recognized as a broad estimate only. Diversion was not generally measured in the study (RCO, 1993). For those who did not compost, inconvenience and the extra effort required were recognized as important barriers.

Another one-year, multi-family composting demonstration was carried out in Waterloo, Ontario, beginning in June, 1991. Findings of this study are presented in Table C.4. The purpose of this study was to identify successful composting systems for multi-unit purposes. Two townhouses, two apartments and a fifth, unspecified dwelling, were included in the study. As in the Metro Toronto project, volunteers were responsible for maintaining the program, and were advised by the City of Waterloo and a Citizens' Recycling Committee. Composting bins were provided to participants free of charge.

This study tested 2 and 3-bin composter designs, with one single-unit bin provided for overflow. After one year, two sites reported dramatic waste reduction, and the overall project was rated as a success at three of the five sites. The other two rated the project as a moderate success. Again, convenience to residents appears to have been a critical factor in promoting waste diversion through composting.

Table C.2

Metro Toronto 3-Bin Pilot Project

Twenty-five 3-bin composters are located at housing co-operatives and apartment buildings in Metro Toronto. The bins at each site are maintained by resident volunteers or a Compost Committee.

Location	Dwelling Type	Composter Type	Program Start Date	Participation Level	Methods of Education	Comments
Bain Co-op	Townhouses, 254 units around 7 courtyards, much green space	Seven 3-bins	1991	50-60%	Workshop by Master Composter, signs on bins, tips in newsletter, phone tree for troubleshooting	Residents of each courtyard are responsible for maintaining their own bin. Samples of compost were displayed in Co-op office. Compost used on site for gardening.
Harbourside Co-op	Townhouses, 3-story, 55 units, much green space	3-bin	1991	75%	Meetings, flyers, signs on bins.	Volunteer-managed program. Compost used on site on gardens.
Shalom House	Hostel with community kitchen and bi-weekly market	3-bin	Summer 1990	n/a	Workshop led by Metro staff.	Bin is maintained by volunteer community gardening group. Compost used on the community garden.
Spruce Court Co-op	Townhouses, 78 units, much green space	3-bin	November 1990	25%	Workshop by Master Composter, literature to all residents, sign on bin, reminders in newsletter.	Odour complaints led to formation of Compost Committee which now looks after the bin. Compost is used on-site
Swansea Village Co-op	3 Low-rise buildings, 96 units, little green space	32-bin	1991	50%	Workshop by Metro staff, reminders in newsletter, q & a sessions at the bin.	Managed by volunteers. Rat problem was solved by lining the bin with wire mesh.
Oak St. Co-op	Townhouses & two high-rises, 149 units, little green space, co-op with paid caretaker	3-bin	Fall 1991	30%	Pamphlets to all members, presentations at meetings.	Managed by volunteers and caretaker. Bin was relocated due to odour problems. Compost was dug into plant beds.
Charles St. Co-op	Two high-rises, 713 units, no green space, student and social housing	Two 3-bins	1991	25-30 tenants	Brochures, article in newsletter, poster in lobby calling for volunteers.	Bins were not maintained after the key volunteer moved. Bins were removed due to rodent infestations.
One Newholm Road	Low-rise rental apartment building with 27 units, little green space	3-bin	1990	40-50%	Literature to all tenants, signs on bins.	Program managed by superintendent. Compost used on-site in flower beds.
Kalmar Co-op	Seven low-rise buildings, 113 units, much green space, private waste collection	Two 3-bins	1990	50%	Letters to residents, workshop by Metro staff, posters.	Managed by volunteers. Compost used on-site on gardens and as top-dressing on lawns.

Anne Marie Hill Co-op	High-rise and townhouses, 135 units, little green space	3-bin	1990	10%	Newsletter articles, flyers.	Managed by one volunteer. Low level of resident involvement. Compost is used on flower beds.
Norris Crescent Co-op	Street-long co-op of ten, 6-unit buildings, much green space	3-bin	1990	40%	Literature to all co-op members, word-of-mouth.	Managed by volunteers. Compost used on-site.
Heath St. Co-op	Low-rise, 49 units, little green space, private	3-bin	1990	30%	Literature to all co-op members	Some difficulty in getting volunteers to look after the bin. Compost is dug into herb and flower gardens.
York University	High-rises, much green space, not served by municipal collection	Five 3-bins	Fall 1991	10%	Workshop, word-of-mouth, flyers	Managed by volunteers and university grounds staff. Difficulty in maintain volunteer involvement. Bins damaged by wind.
Beverley Sullivan Co-op	Townhouses, 8 units, much green space	3-bin	1991	100%	Literature to all members, word-of-mouth.	Managed by leading volunteer who gradually involved all residents. Compost used on-site.

Source: RCO, 1993

Table C.3

Other Projects in Metro Toronto

This table lists a sampling of sites where groups have set up their own composting projects outside of the municipally-sponsored program.

Location	Dwelling Type	Composter Type	Program Start Date	Participation Level	Methods of Education	Comments
Fieldstone Co-op	67-unit co-op	Two Eco-Balance bins	Fall 1991	30%	Co-op newsletter, flyers on bulletin board, word-of-mouth.	Managed by one volunteer who has found the material difficult to turn in these bins. Compost used on the lawn on sandy soil.
Cawthra Co-op	Low-rise, 84 units in three buildings, much green space	3-bin	July 1990	30%	Newsletter, posters in lobby, literature to all members.	Managed by one volunteer. Finished compost is "almost fought over".
Hugh Garner Co-op	Eight-story co-op with 181 units	3-bin	August 1989	not known	Flyers, meetings, word-of-mouth.	Managed by a Compost Committee. Compost is used on site.
Saulter Park	Bin is in a vacant-lot-turned-community-park	3-bin	June 1992	10-15 house-holds	Door-to-door contact, brochures, signs posted around the neighbourhood.	Managed by the Compost Committee of the Saulter Street Residents Association.

Source: RCO, 1993

Table C.4
Waterloo Demonstration Project

The Waterloo multi-residential demonstration project was a joint effort of the City of Waterloo and the Waterloo Citizens' Recycling Committee. Five Dwellings of various types were provided with 3-bin and backyard composters.

Location	Dwelling Type	Composter Type	Program Start Date	Participation Level	Methods of Education	Comments
285 Sandowne Drive	Townhouse condominiums, 36 units, much green space, managed by a private company, private contractor collects garbage	Two 3-bins	Summer 1990	50%	Pamphlets, general meeting.	Managed by volunteers. Compost is used on gardens and re-used in the bin. Waste collection costs reduced by half.
Robinwood	Townhouse condominiums, 116 units, much green space, private garbage collection	Two 3-bins and seven backyard composters	1990	50-75%	Newsletter, brochures, flyers, meetings.	Managed by volunteer committee. Compost used on-site. Waste collection costs reduced by $200/month.
155 Lincoln Road	6-story rental building, 46 units, "Y" housing for women, some green space	3-bin	1991	30%	Instructions given at tenants' meetings.	Managed by one volunteer. Compost used on-site in gardens.
400 Parkside Drive	High-rise, 108 units, rental building	3-bin	1990	not known	Meeting, literature to tenants, notices, word-of-mouth	Managed by volunteers. Each household given a key to access the bin.
225 Benjamin Road	Townhouse condominiums, 84 units, some green space, private garbage collection	One 2-bin unit and four backyard composters	1990	50%	Newsletter, word-of-mouth	Managed by volunteers. Compost is spread on flowerbeds and lawns of common areas.

Source: RCO, 1993

Participation was surveyed, but not accurately measured. After one year, participation was estimated to range from 10% to 29%, although it is estimated that it could be increased to 50% with extensive promotion and education efforts. A waste diversion rate was not measured (Farkas, 1992; RCO, 1993).

In Barrie, one large building has been operating a centralized composter (Envirocycle 5000) in the garbage room of the building. Residents have been diverting approximately 90 kg to 115 kg per week of raw food waste, and producing approximately 34 kg per week of finished compost. It is estimated that of the 110 units in the building, 35% to 40% have been participating (Collins, 1994).

Several other studies have been conducted to identify potential impacts of multi-family composting on waste diversion, using a variety of different bins and techniques (including vermicomposting) in various types of buildings. These include studies in Mississauga, Markham, Thornhill, Kingston, Vancouver, and Europe, some of which are currently in progress. Findings of the Ontario projects are presented in Table C.5, and findings of projects reported in Vancouver and Europe are shown in Table C.6.

These projects utilized varying types of bins, placed different emphasis on and dedicated various levels of resources to resident education. Combined with different levels of maintenance and types of source separation, these factors are likely to reflect in varied results of the projects. Several of the projects have reported technical problems with odours and flies. As in the Metro Toronto and Waterloo studies, participation is reported to be affected by convenience and residents' levels of interest in waste diversion. Results (and anticipated results of the studies in progress) do not appear to contradict findings of studies conducted in Metro Toronto and Waterloo.

A project undertaken by multi-family residents in Zurich, Switzerland should be highlighted for its apparent successes. It involves 13,000 to 14,000 households (or 10% of the city total). The residents volunteer time to maintain several compost piles, with one resident assuming responsibility as lead caretaker. The city provides collection containers and land, leaving the bulk of the initiative to residents. The project is encouraged through local regulations that support composting, with a new requirement that landlords provide a place for composting activities. This program, which began in 1985, continues to operate successfully (RCO, 1993).

From the evidence presented to date, it is believed that, despite initial skepticism, multi-family composting can be an effective practice for increasing waste diversion if it is carefully monitored and units are maintained. Participation levels and success rates are closely linked with effective education programs. Participation rates tend to increase over time, unless education is not effective and active. The RCO report, which documents findings of multi-family composting projects, recommends more detailed study of diversion potential (RCO, 1993).

Summary of Multi-family Composting Data

Data collected to date suggest that participation in neighbourhood and community based composting programs by multi-family residents is lower than in single-family households. An estimate of 54 kg/hh/yr for multi-family composting of food waste in central units has been assumed for this study, based on the results of a study conducted in Barrie, Ontario, where multi-family households participated in a pilot project to compost food waste (Collins, 1994).

Table C.5
Other Projects in Ontario

Location	Dwelling Type	Composter Type	Program Start Date	Participation Level	Methods of Education	Comments
Mississauga	High-rise, 20 stories	(material composed off-site)	1991	Very low	Meeting called for residents, information provided.	Experiment to test collection. Tenants carried food waste in plastic buckets to a cart outside of the building.
Barrie	Various multi-unit dwellings	Worm bins, balcony bins, backyard bins, 3-bins, trial operation of Envirocycle 5000	Launched in Fall 1992	Approximately 100 units with balcony units, and 35% to 40% of units in one building using Envirocycle 5000	City waste management newsletter, presentations to building owners and managers, information package to residents, display in common area of buildings.	Surveys of residents with individual units have indicated poor results while the centralized unit has been operating successfully, diverting 90 kg to 115 kg per week of raw food waste from 30% to 40% of units in the building.
Markham	High-rise, 52 units, privately-owned building with private waste collection	3-bin	1991	40%	Information meetings, reminder notices, word-of-mouth	Program initiated by the property management company, composter maintained by superintendent
Thornhill	High-rise, 140 units, privately-owned building with private waste collection	3-bin	Summer 1992	Not yet known	Information meeting	Composter is maintained by superintendent
Kingston	High-rise, 125 units, rental building on large lot	6 Eco-Guardian bins	August 1991	75%	Meeting, delivery of notices, word-of-mouth	Program initiated and managed by the superintendent. Tenants place food waste in a collection bin in the garbage room. After minor vandalism, bin doors were attached with chains. Compost is used for landscaping and given to tenants for their plants.

Source: RCO, 1993

Table C.6

Multi-Residential Projects in Vancouver, Helsinki and Zurich

Location	Dwelling Type	Composter Type	Program Start Date	Participation Level	Methods of Education	Comments
Community Alternatives Co-op, Vancouver	3-story co-op	Homemade rotating barrel in basement	1983	100%	Not known	Initial odour and fly problems. Modifications improved the system's performance. Compost is used on-site on fruit trees and gardens.
Helsinki, Finland	11 apartment blocks at Helsinki University	600-litre insulated steel bins	1987	40%	Guide called "How to Compost on Blocks of Flats"	Bins are maintained by volunteer compost caretakers at each site; duties are rotated among a few people.
Zurich, Switzerland	Various multi-residential buildings	Collection bin and 3 or 4 piles for composting	1985	10% of population	City staff provides information, advice and site visits	A volunteer resident leads each compost project. Maintenance of the pile is shared by participating households. Compost is used by residents on their balcony gardens and window boxes.

Source: RCO, 1993

Mid-Scale On-Site Composting

Like multi-family composting, Mid-Scale On-Site Composting is in an early stage of development. A summary of several projects is presented in Table C.7. At present, mid-scale facilities are reported to have high capital costs (in the range of $5,000 to $25,000). However, the facilities are easy to operate and one type presently on the market may be located indoors. Preliminary studies show that mid-scale, on-site composting projects may have the potential to process large amounts of waste, from about 45 to 90 kg/day (RCO, 1993). However, due to lack of systematic data collection, results are currently considered inconclusive. For that reason, these figures are not factored in waste diversion estimates for the GTA.

Experience with Mid-Scale On-Site Composting

Composting units presently in use for Mid Scale On-Site Composting include the:

- Mid-Scale Rotating Barrel
  A "home-built" composting barrel has been operating at Ecology Park in Toronto since August, 1992. This unit receives food waste from two neighbouring natural food stores. The unit is a cylinder with doors on both ends, that rotates on casters and can be manually rotated. The unit can receive up to approximately 3 tonnes per year.

  Material is kept inside the chamber and composted with wood chips for up to four weeks, at which time it is turned into a vermicompost barrel. From start to finish, the process requires approximately 6 weeks to produce a finished compost product (RCO, 1993).

- 3-Bin Units
  Bell Canada in Etobicoke is using a 3-bin wooden composter system to compost food waste from the cafeteria and all 12 floors of an office building. Together, the composters receive approximately 35 tonnes of source separated compostable material/yr and are composted with leaves, soil, and wood chips for bulking when necessary. Material is aerated by turning, and the finished compost product is used on-site or sold by a charitable organization for fundraising (RCO, 1993).

- Mid-Scale Vermicomposting
  Harbourfront, in Toronto, installed a vermicomposting system in August 1992, which is used to divert food waste from three quick-service food outlets from disposal. Food waste is source separated, and meat scraps are removed. Food waste is mechanically shredded before being fed to the worms.

  The system is made up of 16 worm bins that are enclosed in an insulated metal container with hinged locking covers. A heat/ventilation system ensures that air is allowed in but heat does not escape. The system is capable of receiving between 13 and 22 kg per day. Some problems (associated with system overload) have been experienced with odour and fruit flies. However, technical problems are easily mitigated by reducing loads.

  The production cycle takes approximately 2 to 3 months, and finished product has been used on-site at Harbourfront. The capital cost of the system was $10,000 (RCO, 1993).

Table C.7

Mid-Scale Commercial and Institutional Composting Sites

Site	Composting System	Feedstock	Costs	Comments
Bell Canada Office Tower, Montreal	Envirocycle 5000 by Vision Recycling: Three rotating cylinders encased in fibreglass box, powered by a motor	Non-fatty food preparation waste from 14 food service outlets	$5,900 and $30/month for peat moss (optional) Capacity is 100 pounds/day	Unit is located inside the building. Building maintenance staff collect the food waste and operate the composter. Compost is removed every 2 week.
Mimico Correctional Centre, Etobicoke	Ecolyzer by Eco Corporation: in-vessel mechanized system with two chambers	100 lbs./day of plate scrapings and food preparation waste	$20,000 or $575 to lease monthly	Unit is located outdoors by the food service area. Liquid is strained before food waste is added to the system. Compost is removed after 30 days.
Ecology Park, Toronto	Rotating barrel by Grow T.O.Gether Community Gardeners: 8' long cedar cylinder with two sections divided with hardware cloth, rotates with aid of a boat winch	100 lbs./day of food waste from local natural food stores	$4,000 for construction	Designed, built and operated by volunteer community gardeners and RCO Master Composters. Compost is removed after four weeks to an insulated holding unit for final decomposition.
Harbourfront, Toronto	Mid-scale vermicomposter by Vermitech Systems: 16 worm bins enclosed in an insulated metal container	50 lbs./day of food preparation waste from Harbour front restaurants	$10,000	Maintenance staff operate the system. Food waste is put through a shredder before being fed to the worms. Compost is harvested after a few months by Vermitech Systems.
Bell Canada building, Etobicoke	3-bin wooden composters by Butler & Baird	100 lbs./day of food waste from the cafeteria and from all floors of the building	$12,000	Employees deposit food waste into containers on each floor by the elevators. Maintenance staff carry out food waste and maintain the bins.

Source: RCO, 1993

- Envirocycle 5000
  The Bell Canada tower in Montreal is composting food preparation waste from food service outlets in this unit. Source separated organics (with grease discouraged) are placed into the rotating cylinders with peat moss added as a bulking agent. The unit is powered by a motor, and rotates 6,000 time per day, with constant aeration. Finished compost is produced within about two weeks. Approximately 240 tonnes/yr are diverted through ongoing use of the unit. Capital cost of the unit was $5,900, with an added annual cost of $360 for peat moss and $1/day electricity (RCO, 1993).

  As discussed above, a residential building in Barrie, Ontario also has been operating this unit successfully, diverting from 5 to 6 tonnes/year of raw food waste, and producing approximately 1.8 tonnes of finished compost per year (Collins, 1994).

- Ecolyzer
  The Ecolyzer is an in-vessel mechanized composter that has been used since 1992 at the Mimico Correctional Centre. The unit composts approximately 50 kg/person/year from the 350 inmates.

  Plate scrapings and food preparation scraps are composted in the unit (with the preferred exception of grease and bones). Each cycle requires approximately 55 kg to 75 kg of peat moss as a bulking agent. The unit operates on a 30 day cycle, where food is placed in one of two units for the first 15 days, and then composted while the other chamber is filled. Computer controlled aeration and temperature controls are applied as the compost is electronically mixed. Each cycle produces approximately 225 kg of finished compost.

  The Ecolyzer unit is sold for approximately $20,000 (RCO, 1993).

At present, the bins require high capital costs (from $5,000 to $25,000), although it is likely that cost will decrease with increased sales. Energy costs associated with mechanized versions further increase operating costs.

Future Research in On-Site Composting

Until further research is completed, reliable waste diversion estimates focusing on actual waste diversion or potential for diversion through on-site composting are not available. Research into actual participation rates and diversion of each of the above "other" on-site composting mechanisms may provide the level of reliable data that could be used in preparation of accurate diversion estimates attributable to these mechanisms. Further research in this area is warranted.

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SCHEDULE D

RESIDENTIAL DIRECT COST

SCHEDULE D — RESIDENTIAL DIRECT COST

Introduction

In a Direct Cost System, waste generators pay for waste collection on the basis of the amount of waste generated. Most commonly, the rate structure increases with greater quantities of garbage collected. Direct Cost is current practice for most IC&I wastes, and can be applied to the residential sector through pay-by-the-bag, selected level of service, number of cans, etc.

The advantages of a Direct Cost System include:

1. It creates an economic incentive for waste reduction.
2. Lower quantities of garbage are sent for disposal.
3. Residents realize cost avoidance through waste reduction.
4. Residents pay in proportion to the wastes generated (this system is a step towards full cost accounting).

The disadvantages of a Direct Cost System are as follows:

1. It may be initially received negatively by the public.
2. It may discriminate against low income or high occupancy households.
3. It requires complex administration and can often be expensive to implement and operate.
4. It may lead to illegal dumping and burning.
5. It may be difficult to control some of the problem elements (such as over-stuffed and heavy bags/containers).

Types of Direct Cost System

There are a number of types of direct cost programs. These include:

Metered bag

In this system, standardized marked bags can be purchased at local retail outlets, or are given to the householder by the city.

Metered tag

In this system, marked tags (that stick to bags or are tied to cans) are sold to the householder. The distribution networks for these tags are the same as for metered bags. Some form of volume restriction is generally used with metered tags. This limits the size of container to which the tag can be attached (e.g. maximum 30 gallon volume).

Per container/bag rate

In this system, the generator pays for the number of containers or bags set out. Some communities restrict the number of garbage containers which can be used by one household.

The hauler is responsible for monitoring the number of bins or bags set out by each household. Any kind of container is accepted in this system.

Graduated per container rate

In this system, generators pay an increasing amount for additional containers. The hauler monitors the number of bins set out by each householder. Any kind of container is accepted.

Weight-based charges

In this system, the amount of general waste sent for disposal by the generator is weighed as it is collected and the charge to the householder is based on this weight. Usually an electronic system to track weights from each household is required for the implementation of weight-based charges. Although this type of system might encourage higher diversion than volume-based systems, the level of complexity has prohibited its widespread use to date. However, some municipalities are conducting trials with weight-based systems and the required technology is expected to become more available in the future (Skumatz, 1990, 1991; Andresen, 1992).

Standardized container rental

In this system, a bin is rented from the hauler by the householder. The rental fee for the container and the waste collection service is charged monthly.

Container licenses

In this system, households purchase an annual license for each container placed at the curb. The fee varies with the size of the container.

Volume restriction

In this system, residents can only place a maximum number of containers (of a limited size) at the curbside. This system is not very popular. It can be combined with a fee, as with other systems described above.

Reduced rate option

In this system, residents who consistently generate low quantities of waste pay a significantly lower flat rate than the regular collection fee.

Successful implementation of a direct cost system requires a number of elements. These include:

Education

It is important to prepare the community by stressing and explaining the fairness of the system. An on-going public education program, including the distribution of waste reduction information, and showing waste management's costs as a separate item on the homeowner's tax bill, will provide the community with the background knowledge they require to support the system.

3Rs Opportunities

It is necessary to ensure that the community has access to public systems that encourage them to reduce, reuse and recycle their waste. These include curbside collection of recyclables and yard waste, distribution of backyard composters, household hazardous waste depots or pickup, etc.

Convenience

The Direct Cost System must be convenient for the community to use. There must be a distribution network set up for bags/stickers/containers to ensure that they are readily accessible to the public. The distributor must be fairly reimbursed for their costs. This will encourage their on-going participation in the program.

Enforcement

Some form of enforcement is necessary to keep the system operating smoothly. Methods are needed for solving potential illegal dumping by the homeowner. Keeping enforceable weight limits (50-60 lbs./bag) on containers discourages over-compaction of the containers.

Level of Charge

If the charge to the homeowner is too low, the program may not be a very effective economic incentive for waste reduction. However, if the charge is too high, it may encourage illegal dumping or burning of waste, tag theft, etc. It may be convenient for the municipality to institute a minimum fee equal to the cost of one bag/week, in order to overcome the problem of uneven cash flows.

Direct cost systems have been implemented in a number of rural communities in Ontario, and in a number of cities in the United States. Some of these systems are described below. Table D.1 summarizes information on a number of direct cost programs. A few case studies are discussed below.

Town of Gananoque

The Town of Gananoque was the first municipality in Ontario to implement a full direct cost garbage disposal system. Both single and multi-family dwellings are included in the program. The system was introduced in 1991. The waste disposal fee was removed from the 1991 tax bills, but the fee for waste collection remained on the taxes. A charge of $1.00/bag was charged to break even on the cost of waste disposal. Tags were made available to residents in sheets of 12 from grocery stores or the townhall. No commission was paid to the distributors. In response to some initial complaints about the program, the town implemented a "2 for 1" program, in which residents received one free garbage tag in return for every 2 bushels of recyclables delivered to the depot.

The results of the program were a 45% reduction in waste collected (from 32 to 16 tonnes per week) after program startup. The quantity of recyclables arriving at the depot increased from 8 tonnes to approximately 22 tonnes per month, which amounted to 275 tonnes in 1992, or 23.5% of the waste stream (Cummings, 1993). Composter distribution doubled to cover 50% penetration of the residential households. There was also a noticeable change in consumer habits, as residents began to switch away from over-packaging and non-recyclable packaging.

Some of the problems encountered with the program included illegal dumping, use of commercial bins for (illegal) disposal of residential waste, use of half-tags or counterfeit tags,

Table D.1
Summary of Data from Selected Direct Cost Programs

Location and Reference	Population	Date of Implementation	Waste Reduction Initiatives	Before Direct Cost (y/n/some)	Description of Program	Overall Diversion Rate in Jurisdiction	Information on Diversion Impacts (if available)	Comments on Program
Town of Kincardine, Ontario (18)	6,500	1-May-93	Crubside recycling	No	Mandatory tag system ($2/tag)		Dramatic decrease in garbage (estimated at 50%)	Recycling collection and backyard composter sales have increased. Increased activity at leaf composting facility drop-off
West Garafraxa Township (19)	3,147	August, 1992	Curbside recycling, demonstration community for home composter program		Voluntary tag system ($2/tag)		Weight of garbage per household per week has gone from 31 to 20 lb	About 50% of population is on system
Marion County, Oregon (2,13)	228,000	decades previous	Curbside blue-box,Recycling depots, Yard Waste drop-off		Variable rate set by cities or county ($9.20-$15.20), Multi-family charges higher	27-34%		
Seattle, Washington (1,2,7,9,10,14,15)	495,000	1981	Curbside and drop-off recycling, fee-based yard waste collection	No	Rate set by city/hauler ($10.80/1 can, $12.85/2 cans etc.) Seattle ($5.95/can, $9 per extra)	40% (1991)	24% diverted before municipal recycling programs implemented	Experiment with weight-based charge seems promising
Tomkins County, NY (2,16)	96,000	March 1990	Curbside recycling, Yard waste curbside collection and drop-off		Service fee (system charges) tag fee (covers tipping)	30% (7.2% is sewage sludge)	Can weight down 10 lbs (to 20 lbs) with tag and recycling programs	Questionnaire indicates higher recycling participation
Hennepin County, Minn. (2)	1,000,000		Curbside and drop-off recycling programs, Curbside yard waste		Cities, flat fee with R3 credit, haulers variable can rates ($15/mon. 1 can, $18/mon. two cans, etc.)	50%	38% drop in waste generation	Recycling Credits (14-42% of collection charges in some areas)
Town of Gananoque, Ontario (3,4,5,8,10,17)	5,000	July, 1991	Depot recycling, Home composter program	S,Y	Mandatory tag system, $1.00/tag		Substantial decrease in waste at transfer station since direct cost	Free tag for two bushels at recycling station. Home composter demand up
Township of Westmeath, Ontario (10)	2,300	September, 1991	Recycling depot, Curbside recycling, Backyard Composting	N (curbside), Y (others)	Special bags, $3.00 each		Unquantifed waste decrease reported since direct cost implemented.	Increase in composting and recycling programs since direct cost implemented
Township of McNab, Ontario (10)	5,200	October, 1991	Curbside Recycling	Yes (1989)	Special tag for more than four bags ($1.00 per tag)			
Village of Woodville, Ontario (10)	675	September, 1991			Colored bags ($1.25/bag)		Direct cost system discontinued in 1992	County control of waste disposal made user-fee unnecessary.
Borough of Perkasie, Penn. (1,6,7,10,13,15)	7,900	January, 1988	Curbside and depot recycling.	Yes	Mandatory bag system ($2.00 - 40 lb bags, $1.25 - 20 lb bags)	32%	18% drop in waste generation	Increased recycling.
Carlisle, Penn. (6,7,10)	19,000	June, 1990	Curbside recycling		Mandatory bag system ($2.10/bag)	30%	Garbage has decreased	Recycling increase.
Duluth, Geo. (7,10)	10,000	1970	Curbside recycling	N (1989)	Mandatory bag system ($15.50 for 20 bags)			Recycling has increased. 48% weekly participation rate.
Grand Rapids, Mich. (7,10,13)	170,000	1971	None		Mandatory bag and tag system ($.65/tag, $.75/bag)		Increased illegal dumping as disposal costs rise	
High Bridge, NJ (7,10,13)	3,800	1988	Curbside recyclables collection (no blue-box supplied)		Mandatory tag system ($1.60 per sticker)		Garbage decreased 21%.	
Holland, Mich. (7,10,13)	30,000	1988	Recycling extra charge		Coloured bag program, customer owned containers or supplied containers.			Illegal dumping minor problem.
Lansing, Mich. (7,10)	120,000	1974	Curbside recycling	N (1991)	Optional bag program ($1.50/bag). Can use private hauler is desired.			

Table D.1
Summary of Data from Selected Direct Cost Programs

Location and Reference	Population	Date of Implementation	Waste Reduction Initiatives	Before Direct Cost (y/n/same)	Description of Program	Overall Diversion Rate in Jurisdiction	Information on Diversion Impacts (if available)	Comments on Program
LaTrobe, Penn. (7,10,13)	10,000	1962	Curbside recycling		Mandatory bag program ($6.50/25 bags)		No increase in garbage, stable levels.	Recycling levels stable. Problems with garbage imported from out of town.
Olympia, Washington (7,10,13)	30,000	10-15 years previous	Curbside recycling	N (1989)	Mandatory container system (variable (charge with recycling credit)	28%	No increase in garbage.	
Plantation, FL (7,10,13)	69,000	1975-1976	Curbside recycling	N (1990)	Mandatory bag system ($1.20/bag)			Recyclables declined slightly in 1992.
Wilkes Barre, Penn. (6,7,10,13)	47,500	1988	Apartment blue-bag program	1988	Optional Blue-bag system for apartments ($1.00/bag). Households pay flat fee for garbage collection.		15% reduction in garbage produced.	Recyclables weight steady.
Woodstock, IL (7,10,13)	16,000	1987	Curbside recycling	1987	Mandatory bag system ($1.98/bag)		Decrease in garbage.	Steady increase in recycling since program introduced.
St. Cloud, Minn. (12)	48,812	July, 1991	Curbside collection	S (1991)	Mandatory bag system ($2.00/bag, max 25 lbs). $1.00/clear yard waste bags.		Recycling doubled, 50% reduction in waste requiring disposal	Some illegal dumping
Village of Ilion, NY (7,10,13,15)	8,888	June, 1988	Curbside collection		Mandatory bag system ($2.00 and $1.75 bags)	52%	44% decrease in waste generation	Recyclable weights increased. Illegal dumping up 2%.

(1) Andresen, Katya, "Communities Weigh Merits of Variable Rates", World Wastes, November 1992.
(2) CH2M HILL Engineering Ltd./Synergic Resource Corporation, "A CRD Wide User-Pay System for Solid Waste", prepared for the Capital Regional District and the BC Ministry of Environment, Lands and Parks, 1992.
(3) Cummings, Christopher, "Town reduces waste 50% with bag-tag system", Civic Public Works, March/April 1993.
(4) Flaherty, Lora, "Gananoque cuts waste by 40%", Alternatives, 19:3, 1993.
(5) For R Information (staff), "User-Pay System Cuts Waste, Boosts Recycling", For R Information, Winter 91-92, p.2.
(6) Harder, Greg and Knox, Linda, "Implementing Variable Trash Collection Rates", Biocycle, April 1992.
(7) Morris, Glenn and Byrd, D., "Unit Pricing for Solid Waste Collection", Popular Government, 56, Fall 1990.
(8) Ontario Recycling Update (staff), "Gananoque 'bag tag' program reduces garbage, increases recycling", Ontario Recycling Update, Jan-Feb 1992, p. 5.
(9) Pealy, Nick and Ostrom, Aaron, "Seattle's Road to Recovery", Seattle Solid Waste Utility, 1992.
(10) Proctor and Redfern, Ltd., "Town of Cobourg's Curbside 'User-Pay' Feasibility Study", prepared for: the Town of Cobourg, January 1993.
(11) Resource Integration Systems, Ltd., "Generator Pay Systems: A Discussion Paper", prepared for: the Recycling Advisory Committee, 1990.
(12) Schmidt, Susan and Krivit, Dan, "Variable fee systems for Minnesota", Biocycle, September 1992.
(13) Skumatz, Lisa and Breckinridge, Cambell, "Variable Rates in Solid Waste: Handbook for Solid Waste Officials", USEPA, 1990.
(14) Steuteville, Robert, "Taking the Lead in Urban Recycling", Biocycle, November 1992.
(15) Stone, Sarah, "Charging Households for Waste Collection and Disposal: The Effects of Weight or Volume-Based Pricing on Solid Waste Management", US EPA, 1990.
(16) Stone, Sarah and Harrison, Ellen, "Residents Favor User Fees", Biocycle, August 1991.
(17) Thivierge, Marc, "The Gananoque Bag-Tag Program", Town of Gananoque, 1992.
(18) As per conversation with Bevan Ferrel, Recycling Co-ordinator, Town of Kincardine, October, 1993.
(19) AMRC User Pay Program Implementation Kit, November, 1993.

public misconception that the town was charging twice for garbage disposal (i.e. on taxes and with tags), and some multi-residential tenants were storing garbage. The town has amended a bylaw so that it can now clean up waste and charge for their services.

Seattle, Washington

Seattle instituted a variable can rate structure in 1981, whereby residents paid more for additional cans of waste to be picked up. In 1989, the City adopted an Integrated Solid Waste Management Plan, with the goal of achieving a 60% reduction/recycling level by 1998 (Pealy and Ostrom, 1992). They determined that restructuring rates to encourage recycling would not, by itself, increase recycling. The City evaluated a number of different rate options, and recommended a substantial increase to the additional can rate (the charge for each additional can after one can of service), as well as offering a "mini-can" service (a 19 gallon can instead of the regular 32 gallon can), and introducing a curbside collection program for yard waste. The cost for the one-can rate stayed essentially the same (from $13.55/month to $13.75/month), but the "additional can rate" went from $5.00/month to $9.00/month. The mini-can service was priced at $10.70/month. Note that the cost of curbside recycling is covered by the basic one-can rate, whether mini or regular can. This provides a stable source of revenue for the curbside recycling program, and encourages recycling by making garbage disposal look more expensive relative to recycling, which appears to be "free". The curbside collection of yard waste, which began in 1989, is available for an additional charge of $2.00/month.

To address the problem of occasional extra waste, customers can purchase stickers to attach to each bundle of waste. The stickers are sold for $5.00 each at various locations throughout the city. Residents can place extra waste at the curb in a bag, box or bundle on their regular garbage collection day. Extra waste is not collected without a sticker.

Eighty-nine percent of the City's single family garbage customers subscribe to one-can or mini-can service (64% are one-can customers, and 25% are mini-can customers). Only 1% subscribe to two or more cans of service. This contrasts sharply to 1988 percentages, when 60% of single family customers subscribed to one can, and 39% subscribed to two or more cans. Seattle's residents have reduced the average number of cans put out for pick-up from 3.5 to just over 1 can. Between 1986 and 1989, residential waste tonnage fell by 25%. Prior to the introduction of the city-sponsored recycling program, the recycling percentage in terms of actual tonnes of waste diverted was over 24% There is a 75% sign up rate for the curbside recycling program. The program collects about 3,500 tons per month, or an average of 63 lbs./hhld. Over 60% of Seattle's customers subscribe to the City's yard waste collection and composting program. In 1989, the curbside yard waste program diverted over 27,000 tons of residential waste to a composting facility.

There was some concern about the effect of the rate changes to low income customers and charitable organizations. These low income customers receive 77% off the basic one-can service. The cost of additional cans is reduced by 22%. The City offers subsidized dumping rates at the transfer stations for certain charitable organizations (about a 35% discount).

Perkasie, Penn.

Perkasie is a small town in suburban Pennsylvania with a population of 7,900. A direct cost program was started in 1988 at the same time as a curbside recycling program. This is a mandatory bag program with prices ranging from $1.25 for a 20lb bag to $2.00 for a 40lb. In 1988, the Borough diverted 900 tons from the 2800 ton total requiring disposal in 1987, a net 32% diversion (Stone, 1990). An estimated 410 tons of this diversion came from increase recycling activity. The remaining 490 tons is assumed to have resulted from a decrease in the amount of waste generated.

Ilion, NY

Ilion is a small town in rural New York State roughly half way between New York City and Buffalo. The population of the town is 9,190. A direct cost program was initiated in the town in 1988. After the implementation of the program, significant changes to waste generation and disposal patterns were noticed.

The overall amount of waste collected and sent to landfill went from 4,380 tons in 1987/1988 to 2,120 tons in 1988/1989. This represents a reduction of 52% in the quantity of waste disposed. The amount of material collected in the recycling program went from 170 tons to 410 tons in the same time period. However, the increased recycling activity in no way accounts for the reduction in disposed tonnages. The total waste collected (recycling + disposal) fell 44% (4,550 tons to 2,530 tons).

Diversion Potential

All direct cost systems appear to achieve reductions in the quantities of waste sent to disposal. Table D.2 illustrates the diversion achieved by the four programs considered in detail.

Table D.2
Reported Residential Waste Flows (tonnes/year)

Location	Waste Generated (tonnes or tons)	Recycled (tonnes or tons)	Landfilled (tonnes or tons)
Gananoque, Ont.			
Before Direct Cost	1760	96	1664
After Direct Cost	1096	264	832
% change	-38%	+175%	-50%
Seattle Wash.			
Before Increase	225,600	40,600	185,000
After Increase	232,400	44,400	188,000
% change	+3%	+9%	+2%
Perkasie, Penn.			
Before Direct Cost	2,800	0	2,800
After Direct Cost	2,310	410	1,900
% change	-18%	NA	32%
Ilion, NY			
Before Direct Cost	4,550	170	4,380
After Direct Cost	2,530	410	2,120
% change	-44%	+141%	-52%
(Data from Morris and Glenn, 1990; Cummings, 1993)			

It should be noted that although Seattle's waste disposal did not fall with the increase in price for disposal, this program had been established for a long time and most residents have probably altered waste generation habits. Also, more recent reports (Pealy and Ostrom, 1992) indicate that waste requiring disposal has fallen an additional 24% since the program change (however, no specific numbers were reported). Although the amount of waste disposed after implementation of direct cost systems seems to be quite dramatic, it is difficult to determine exactly what the effects of implementing this type of program might be. In the case of recycling participation, residential participation rates can be expected to increase in a fashion similar to

the case studies. However, the level of diversion achieved by source reduction is more difficult to quantify. The programs studied did not identify the manner in which the waste was diverted, for instance, through increased backyard composting, burning or illegal dumping. With the present literature, it is impossible to accurately quantify the source reduction expected implementation of a Direct Cost System. As a result, it was assumed that the level of source reduction in a Direct Cost System would be the same as in the Existing/Committed system, with increases in the level of participation in the recycling program, including Blue Box, leaf and yard waste separation and backyard composting.

Costs

A cost-related problem identified in Northfield, Minnesota is that residents are compacting their waste in order to put out as few bags as possible at the curb. This compaction does not change the weight of the waste, hence the payment collected for the volume of waste is insufficient to pay for tipping fee charged for the weight of the waste.

A number of additional administrative costs and problems associated with implementing a direct cost program were identified in Seattle. These include:

- Additional staff required for administering a variable-can rate structure
- Additional public information staff required to handle increased customer inquiries.
- A trained rates staff is required to design and implement the program. Seattle added two full-time staff, with strong economics backgrounds, to manage its rate development process (Pealy and Ostrom , 1992).
- Additional staff may be required to handle the promotions and education necessary to make a variable-can structure work.
- Revenues and costs can become less predictable. For example, Seattle did not anticipate the dramatic switch from two cans to one can of service when the Utility's additional can rate increased from $5.00/month to $9.00/month. This switch played a major role in the Utility's 1990 revenue shortfall (Pealy and Ostrom, 1992).

Morris and Byrd (1990) identified a number of additional costs:

- additional labour, materials, and equipment required to collect additional recyclable materials;
- additional labour, materials, and equipment required to collect litter or other diverted waste;
- additional costs associated with monitoring quantities of waste collected from each customer;
- additional costs of enforcing the unit pricing program and related restrictions;
- additional program administration costs.

In a study by Proctor and Redfern (1993), most of the communities surveyed reported that the direct cost system for waste collection and disposal had not contributed to any significant increases in administrative or equipment costs. The coded bag and coded tag systems, in particular, appeared to be the lowest cost programs to implement because in most cases, the distribution of tags or bags was decentralized (e.g. sold through local stores). The volume-based systems did not create any substantial increases in costs for waste management equipment, and most communities charged residents for the full cost of the waste management service. Several programs reported that any increase in administrative costs was primarily based on the need for extensive education and promotion programs at the start of the direct cost program. Even communities with central billing systems indicated that their costs did not increase significantly once the billing system was set up on the computer. One community

reported that their variable container system is expensive because of the rigid containers used in this program compared to bags or tags. The increased expense of this program has been passed on to the householder through higher direct cost payments compared to other programs.

A study carried out of direct cost programs in Perkasie, Pennsylvania and Ilion, New York found that the programs apparently achieved savings that more than offset the additional monetary costs associated with changes in waste collection and recycling programs (Morris and Byrd, 1990). Perkasie's annual costs were approximately 10 percent lower after introducing unit pricing and curbside recycling than they were under the previous fixed fee system. Ilion's costs were approximately 15 percent lower. Programs in both communities consisted of unit pricing and increased recycling. In addition, Perkasie reduced waste collection frequency to once per week from twice per week.

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SCHEDULE E

EXPANDED BLUE BOX

SCHEDULE E — EXPANDED BLUE BOX

Introduction

An Expanded Blue Box system is essentially Blue Box recycling with an expanded variety of dry recyclable materials. It attempts to achieve maximum diversion of recyclable materials using existing or modified facilities, and systems currently available to the municipality. This approach is combined with extensive promotion of backyard composting to allow residents the opportunity to divert organics from disposal.

Types of Expanded Blue Box Systems

The materials that may be collected in an Expanded Blue Box system include any or all of the following:

Plastics
- PET
- rigid plastic bottles & tubes (HDPE, PVC, PP, LDPE)
- film plastic (LDPE)
- foam plastic and rigid trays (PS)

Paper Fibre
- newspaper (ONP)
- corrugated cardboard (OCC)
- boxboard
- polycoat (e.g. milk cartons)
- phone books
- magazines and catalogues (OMG)
- mixed household paper

Metal
- steel cans
- aluminum cans
- aluminum trays and foil

Glass
- clear and coloured glass

Textiles

Standard curbside programs include newspaper, glass, cans and PET beverage containers. Some programs also include rigid plastic containers, boxboard and OCC.

Elements of Successful Expanded Blue Box System

There are three aspects of a conventional Blue Box program that can be enhanced by creating an Expanded Blue Box system:

- expand the range of materials that can be accepted in the Blue Box.
- improve the capture rate of currently collected materials
- increase the participation rate

A key component of an Expanded Blue Box program is the emphasis on preparation of recyclables (including rinsing and sorting) by the public, and an increase in sorting by the collection crew. This is achieved through extensive promotion and education.

An aggressive Expanded Blue Box program can lower the average cost of collection and processing, since costs tend to go down as more boxes are distributed, more materials are added, and capture rates increase.

Case Studies of Expanded Blue Box Systems

Centre and South Hastings - Quinte Regional Recycling
(Quinte Regional Recycling, 1993)

Blue Box 2000 was launched in November 1991. The target of the program is to exceed a 50% diversion in the residential waste stream. The components of the program include an Expanded Blue Box recycling program (residential and IC&I), backyard composting, household hazardous waste program, and waste reduction initiatives. Although the Region had previously been involved in a Blue Box Plus! program (which started in fall 1990), they treated Blue Box 2000 as an entirely new program, with extensive promotional and educational activities. The focus of the launch was on what types of materials were to be collected, and how the householder was to set out these material at the curb.

Materials are pre-sorted into 6 groupings by the householder. Residents use a regular Blue Box, and a number of bags for materials at the curb. The driver then sorts these materials into 7 different compartments on the truck, The allowable materials are all of those listed on the previous page.

Participation studies of 1,200 households were conducted in Belleville and Trenton in the spring and fall of 1992, and spring 1993. The results include:

- average weekly set-out was in the 58% to 62% range;
- Blue Boxes that did not contain the full range of allowable materials were reduced from 4% in 1991 to 1% in 1993;
- Blue Boxes that contained unacceptable materials (e.g. window glass, aerosol cans) were between 4% and 9% of the total (as compared to 22% to 28% in 1991);
- the average capture rate for conventional materials was 79%. The overall capture rate of Blue Box 2000 materials, including non-participants, was 62% in 1992. The lowest capture rates were for mixed paper, film plastic, boxboard and textiles.

The study results showed that participation improved over time, and shows no sign of leveling off to date.

The average recovery rate for the Blue Box 2000 program for all the participating municipalities in Centre and South Hastings was 175 kg/hhld/year. It was 210 kg/hhld/year for urban residents based on the 1992 spring waste composition study. The average value for all participating villages, towns, cities, and rural households with curbside pickup (i.e. no depots) was 204 kg/hhld/year. This compares to an average value of 138 kg/hhld/year for all Blue Box programs in Ontario, and 130 kg/hhld/year for a small central Ontario city with a mature Blue Box program.

Burnaby, British Columbia
(Bischoff, 1992 and 1993)

An Expanded Blue Box program was implemented in Burnaby, B.C. January 1991. A multi-family recycling pilot program ran from April 1991 to May 1992, which included 368 units. This program was increased to approximately 10,000 units in 160 multi-family buildings in September, 1992. The curbside program currently serves 36,000 single-family households,

and the 10,000 multi-family units.

The materials collected include ONP, boxboard, OMG, flyers, glossy paper, packaging material, glass, metal containers, PET and HDPE. Residents in single family dwellings sort their waste into three groupings: Blue Box for mixed containers, reusable vinyl yellow bag for boxboard, OMG, mixed paper, etc., and reusable vinyl blue bag for newspaper.

Residents in multi-family units receive reusable blue bags to store their recyclables. Participants carry the recyclables to a central area, where they are sorted into 3 colour-coded roll-out containers (same groupings as for single-family). The same three-way sort is used on the truck. The collection efficiency is high because the curb and truck sorts are the same.

The results of a 4-week survey showed a monthly participation rate of approximately 90%, and a weekly set out rate of 50-55% in 1991. Approximately 144 kg/hhld/year were recovered by the curbside (single-family) program. The pilot multi-family program recovered an average of 2 kg/unit/week (104 kg/unit/year). In 1992 reported recovery was 161 kg/hhld/yr for curbside (single-family) collection. Multi-family service was operating only for part of the year. This compares to the provincial average of 138 kg/hhld/year for all Blue Box programs in Ontario, and an average of 130 kg/hhld/year for a small central Ontario city with a mature Blue Box program.

Edmonton, Alberta
(Egan, 1992 and 1993)

An Expanded Blue Box program was implemented in Edmonton in 1989. The curbside program currently serves 140,000 single family dwellings, while 11 depots serve 133,000 multi-family units. There are six more depots scheduled to open in 1993.

The materials collected in the curbside program include glass, metals (cans, certain types of scrap metal such as broken tools, small car parts, short lengths of pipe and tubing, eaves trough, etc.), all rigid household plastic (including PET, HDPE, etc.), plastic bags, mixed plastic excluding foam plastic (PS), ONP and inserts, magazines and catalogues, OCC, boxboard, polycoat, brown paper bags. ONP is bagged and OMG are bundled, and both are placed on top of the blue box. Plastics are bagged and clipped to the corner of the box with special clips. OCC and paper bags are bundled and placed beside the Blue Box. All other materials are placed in the Blue Box. Multi-family residents are supplied with mini-blue boxes. They transport the materials to nearby depots, where they are separated into containers. Currently, glass is not accepted at depots since there is no local market. Scrap metals are not accepted, while high grades of paper are.

The results of a 4 week survey indicated a 92% participation rate. In 1992, 29,415 tonnes of recyclables were collected in the curbside program, a recovery rate of 210 kg/hh/yr. 1,526 tonnes of material were collected through the depots. In 1991, a total of 28,812 tonnes of recyclables were collected. The total amount disposed at landfill in 1991 was 130,330 tonnes, representing a residential diversion rate of 18%.

Bluewater, Ontario
(Veilleux, 1993, RCO, 1993)

Bluewater Recycling Association is Ontario's oldest and largest Recycling co-operative, having opened in 1989. It currently serves approximately 43,000 households in 45 municipalities. 38 of the municipalities, 38,000 households, are served by curbside collection of Expanded Blue Box materials, and 7 municipalities, 5,000 households, are served by depot programs. Direct cost programs have been instituted in four of the municipalities, two curbside and two depot

programs.

Materials collected include ONP, OCC, boxboard (excluding depots), fine paper, steel and aluminum containers, aluminum foil, clear and coloured glass, rigid plastics (HDPE, LDPE) and some other plastics. Materials are sorted into four streams at the curb. Recovery rates from the curbside programs in 1992 averaged 209 kg/hh/yr. In the depot program the average recovery rate was 206 kg/hh/yr (RIS, 1993).

The communities operating direct cost programs have seen a significant increase in recyclables collected, from 50% in one community (begun in 1992) to 98% in another community (started in July, 1993).

Mississauga, Ontario
(Rivers 1993 and 1994, Long, 1993)

Mississauga operates an expanded Blue Box collection program. Materials collected include ONP, OCC, OTD, OMG, steel and aluminum containers, PET, HDPE, LDPE, polystyrene, other rigid plastics, drink boxes and textiles.

Data reported for 1992 shows approximately 25,154 tonnes of materials recovered from both single-family and multi-family residences, representing a recovery rate of approximately 184 kg/hh/yr. In 1993 an estimated 22,833 tonnes were recovered, representing an estimated recovery of 44% of targetted materials.

Diversion Potential

The Blue Box Plus! program in Centre and South Hastings, which included conventional Blue Box materials plus boxboard, rigid plastic and corrugated cardboard, achieved approximately 18% diversion of the residential waste stream in 1991. The Blue Box 2000 program diverted 21% of residential waste in 1992. This figure includes recyclables only (Quinte Regional Recycling, 1993).

In Burnaby, approximately 5,200 tonnes of recyclables were recovered in 1991, which is equivalent to a diversion rate of 15% of the residential waste stream (Bischoff, City of Burnaby, 1993).

Approximately 28,812 tonnes of recyclables were collected in Edmonton in 1991. The total amount disposed at landfill in 1991 was 130,330 tonnes, therefore, the residential diversion rate was 18% (Egan, City of Edmonton, 1992, 1993).

In Bluewater the Expanded Blue Box programs have resulted in an average reduction of 30% in waste going to landfill as compared to 1987.

A summary of selected programs collecting an expanded range of materials is presented in Table E.1

Table E.1

Summary of Selected Residential Recycling Programmes With Expanded Range of Materials

Community Jurisdiction	Collection Method: Set-out Method	# strm	Freq	# Hhlds Served	Participtn Rate (%)	Rec. Rate kg/hh/yr	Diversion (%)	Comments	Ref. No.
Bluewater, Ont.	Curbside & depot	4	wkly	37,845-sf 5087-depot	not avail	209-curb 206-depot		Estimate average 30% reduction in materials sent to landfill compared to 1987. 4 municipalities have direct cost system (50% - 98% increased recovery). Estimated 10% of depot materials are IC&I.	1 & 2
Brampton, Ont.								Programme started Ocober, 1993	
Brossard, PQ	Bin	2	wkly	18,000	not avail	106		Switched from bag to bin programme	3
Burnaby, BC	Bin & 2 col. bags	3	wkly	36,000-sf 9,073-mf 45,073	85-90%	161	15% - 1991	Recovery rate does not include mf - limited 8-wk involvement - 1775 te (9,073 mf units). Participation measured 1991	4
Centre & South Hastings	Bin + various Bags/bundles	7	wkly	33,600-sf 4,200-depot 1,000-IC&I	85-91%	191	21%	Recovery rate is for average curbside Blue Box 2000 collection for all C&SH municipalities; it does not incl C&D and bulky items.	5
Edmonton, Alta	Bin & bags/bundles	5 & 6	wkly	140,015	92%	210	18% - 1991	Two collection contracts - north & south. Diversion includes all programmes.	6
Edmonton, Alta	depot	n/a		133,000	not avail	12		Expanded number of depots from 6 to 11 in Oct., 1992. Considering adding glass to depot prgrm.	6
Halifax, NS	Bag	1	wkly	105,900	75%	69		Recovery rate does not include Halifax County which is served only once per month.	7&8
Halton, Ont.								Data not available	7&8
Hoffmann Estates, IL	Bin, kraft bags & bundles	4	wkly	12,000	97	376		Separate collection of reusable goods by Salv. Army	9
Londonderry, NH	Bag & Bin		wkly	7,000	80-85%	175		Switching from bags to bins - preferred	10
Mississauga, Ont	Bin	6	wkly	approximately 137000 single-family and multi-family	not avail	184			11
North Seattle	3 Bins	3	wkly	70,000	66%	331		Twice as much MWP generated as ONP - need for flex compartments Associated with direct cost system. Participation estimated from set-out rates averaged over year	12
Port Moody, BC	Co-coll, Clr Bag	1	wkly	4,000	90-95%	154			13
South Seattle, WA	90-gal cart & bin for glass	2	mthly	78,500	71%	264		Associated with direct cost system. Added separate bin for glass in 1993. Participation estimated from set-out rates averaged over year	12
Vancouver, BC	Bin & 2 bags	3	wkly	90,500	90%	139		Bag for other paper added in 1993. Recovery rate does not include telephone directories, X-mas trees. Also does not include depots. Set-out rate measured at 52%.	14

Community Jurisdiction	Mass	Materials Collected: ONP	OCC	OMG	Box-board	Other Paper	Glass	Fe Cont.	Other Fe	Al Cont.	Other Al	PET	HDPE Rigid	LDPE Rigid	Other Plast.	Poly-coat	Text
Bluewater, Ont.		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Brampton, Ont.																	
Brossard, PQ		✓	✓	✓		✓	✓	✓		✓		✓	✓	✓			
Burnaby, BC	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
Centre & South Hastings	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Edmonton, Alta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Edmonton, Alta		✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	
Halifax, NS		✓	✓			✓		✓		✓		✓		✓		✓	
Halton, Ont.																	
Hoffmann Estates, IL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Londonderry, NH		✓		✓		✓	✓	✓		✓		✓	✓				
Mississauga, Ont		✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
North Seattle	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓					
Port Moody, BC	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	
South Seattle, WA	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓				
Vancouver, BC		✓	✓	✓		✓	✓	✓		✓		✓	✓	✓			

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SCHEDULE F

RESIDENTIAL WET/DRY SYSTEM INFORMATION

SCHEDULE F— RESIDENTIAL WET/DRY SYSTEM INFORMATION

Introduction

The term "wet/dry" is commonly used to refer to a type of solid waste collection program in which the householder is required to separate waste into 2 distinct streams - wet or the organic fraction, and dry, which consists of fibres, plastic, metals, etc. Each stream is stored separately in a container (typically a plastic bag or bin) which, in the case of single family residents, is then taken out to the curb for collection.

There are two main variations of a "wet/dry" system: two stream (wet and dry) and three stream (clean wet, clean dry and residue waste). A four stream system is in use in Europe, but has not been used in North America to date (RIS, 1992, Bennet, R Cave & Assoc., 1988).

In a two stream system no separate residue or "garbage" option is provided to the householder, as residue is pulled from the recyclable or compostable material at a materials recovery facility (MRF) or compost facility.

To date, most trials have required separate collections with two trucks.

Four demonstration scale programs have been completed in Ontario to research the practicality of these collection systems. The host communities for these demonstration programs were:

— the City of Guelph
— the City of Mississauga
— the Region of Halton and
— Metro Toronto

The City of St. Thomas piloted wet/dry collection from 600 households in 1993, and is rolling the program out city wide in May 1994. In addition to these five Ontario programs, a number of other Canadian communities have considered or implemented wet/dry systems. These include:

- Gold River, B.C.;
- District of Lunenburg, N.S.;
- Town of Markham, Ontario;
- St. Thomas, Ontario;
- Prince County, P.E.I.;
- Victoria, B.C.

Some of these programs as well as a selection of European programs are described in the text below, and are summarized in Table F.1.

City of Guelph Pilot Project

Description of System

Research in the City of Guelph was initiated in 1989, with 565 single-family households participating in collection trials. The test area was later expanded to include a total of 872 households.

The test area was used to measure the variation in diversion and householder acceptance rates for an initial 5 different collection scenarios which included various combinations of collection in bags and bins (Laird, City of Guelph, 1992, 1993, Nash, CMA, 1993).

Table F.1

Summary of Selected Wet/Dry Project Information

Study Area	Pilot	Materials	Programme	No. Hhlds Served	Date Started	Total Waste Generated	Reported Recovery Rates				Reported Participation Rate	Reported Diversion Rate	Comments	Ref. No.
							Dry Stream		Wet Stream					
							Total Dry Collected	Dry Recyclables Collected	Total Wet Collected	Compostables Collected				
						(kg/hh/yr)	(kg/hh/yr)	(kg/hh/yr)	(kg/hh/yr)	(kg/hh/yr)	(%)	(%)		
Gold River, B.C.	Full Scale (small)	wet - food, yard, ashes, diapers, animal droppings Dry - fibres, glass cont., drinking glasses, metal food & bev. cont., foil, plastic bags, cont., & wrap, textiles,	2 - Stream	800 hhlds + ICAI				250 tonnes in 1993		380 tonnes in 1993	n.a.	80% for wet/dry collection system, 58% overall	265 tonnes sent directly to landfill - mostly mill waste & some res.	16
Guelph, Ont.	pilot	Wet - food, yard, wet paper Dry - Blue Box, paper, boxboard, rigid plastics, film plastic, PS, other metals	2 - Stream (avg.)	491	Jun 89	1092	561	289	531	443	95	68	32 to 40% of mats recovered in dry stream not currently recycled - recovery rates don't incl. these. Study incl. 47 Ontario subsidized townhouse units - not incl in these data. Processing facility approved - 125,000 t/yr (40,000 t/yr wet)	1 & 2 & 3
	pilot	As Above	3 - Stream (avg.)	334	Jun 89	1050	328	224	391	378	95	61	2-stream recovered higher percentage of recyclables than 3-stream. 3-stream recovered higher quality of recyclable materials than 2-stream. Also 3-stream recovered cleaner wet waste	1 & 2 & 3
Halton, Ont.	pilot	Wet - food (fruit/veg, dry & fish), yard Dry - BB, paper, other metals, rigid plastics, film plastics, PS, aseptic, clothes	3 - Stream	582		1266	442	399	277		wet stream - 40% curb, 17% curb & BYC, 33% BYC only	42	Recovery rates for periods when all materials collected - expanded BB, food and yard waste. Capture rates obtained from Composition analysis of third bag. Diversion does not incl. BYC. Recovery of wet waste incl compostables not requested.	6 & 7
Lunenburg, NS	pilot	Wet - food (except meat), wet paper, yard Dry - Fe & Al cont., PET, film, ONP, glass	3 stream	982	Sept. 1992 Feb. 1993				not available		70% org 90% dry	30% - 23% org. 7% recycl (+ 5% BYC)	Initially planned as two-stream. 60% used BYCs. . Participation measured by survey. Only 30% recyclables not recoverable due to contamination (mostly attributed to incorrect set-out of dry wastes and broken glass with ONP). Freezing occurred in carts.	9
Metro Toronto, Ont.	pilot		3 - Stream	14,700	Nov 91 One year pilot	Results not available - report currently being compiled by Metro Works and R Cave & Assoc.					usually 30%		Based on tour of European prgrms, preferred 3-strm. Survey (20% resp) cited use of BYC as most frequent reason for non-participation	8
Mississauga, Ont.	pilot	Wet - Kitchen (incl meat/dairy), yard, ashes, tissues, diapers, animal droppings Dry - BB	2 - Stream (wet bin)	955	Oct 91	1421	264	253	316	310	35	40	Final report on Mississauga currently being compiled - available end November, 1993.	4 & 5
	pilot	Wet - as above, incl papers eg boxboard, mixed paper Dry - BB	2 - Stream (wet bag)	917	Oct 91	1239	data not available	data not available	219	206	44	Wet - 17% Dry - not available	Participation rates are actually average set-out rates	4 & 5
	pilot	Wet - Kitchen (incl meat/dairy), yard, tissues, animal droppings Dry - BB	3 - Stream (avg.)	1,829	Oct 91	1417	239	229	269	259	37	35		4 & 5
Barrie, Ont.	prop'd pilot		3-stream and, 2 strm + BYC/organics drop-off	500 and 250									BYCs will be distributed to all hhlds in second test area which will be designed to encourage home composting of food and yard waste	3
Markham, Ont.	prop'd pilot	Wet - Kitchen and yard waste Dry - ONP, OMG, OCC, Boxboard, mixed paper, glass cont., fe & al cont., scrap metal, plastics, textiles	3 stream	2,300 Blue Bag 900 Expanded Blue Bag	May 1/94								Townwide survey indicated 85% of residents favoured exp recyclables collection and 79% willing to separate food waste for BYC or curbside collection. Acceptability to be tested in 1-yr pilot. Collection from residential & ICAI sources	10
Newmarket, Ont.	prop'd pilot		3 stream										No details available. Canada Compost Ltd. proposed pilot. Anaerobic digester will process organics	15
Prince County, PEI	pilot													
St. Thomas, Ont.	rolled-out full scale May 94	Wet - kitchen and yard Dry - Blue Box	3 stream	pilot - 1,200	May/June '93						76% to 92%	weekly estimates: 30% to 75% organics 15% Blue Box		17

Table F.1

Summary of Selected Wet/Dry Project Information

Cedar Rapids, Iowa	Feas study	Wet - food, soiled paper, mixed paper, diapers, yard Dry - glass, metal, al, pl, ONP, phone books, OCC	3 stream - recyclables drop-off	35,000	No data Available								Currently 46% participation in recyclables drop-off. Expect 32% diversion initially in wet/dry programme. Expect to run pilot. The city expects to generate 91 tonnes/day of compostable materials.	14
Fairfield, Conn.	pilot	Comp - food, kitty litter, diapers, tissues, sanitary prod, soiled paper, pizza boxes Dry - glass, ONP, metal cans, some plastic cont.	3 stream with wet bag for compostables	386	Mar 92	1229	425		355		64%	63%	30 day pilot. 3 McDonald's restaurants also participated. Yard waste (not collected due to winter) added to compost. High degree of promotion to residents. Level of reject materials in compost not indicated.	11 & 12
Germany	Full Scale	- fibres - ONP, OMG, Mxd paper - Green Dot packaging Waste - organics - food and yard	4 stream separate collection schedules	106,000	sec. sep. organics since 1980s, Green Dot since 1992			200 kg fibres 70 kg glass 47 kg other		270	org 80%, fibres - 90%, glass drop-off - 60%	40 45% - recycling 24% composting 10% source red. 2%	Glass is collected at drop off depots. Garbage and organics are collected on alternative weeks. Fibres are collected monthly. Packaging materials are collected bi-weekly	18
Greenwich, Conn.	pilot	Comp - food, kitty litter, diapers, tissues, sanitary prod, soiled paper, pizza boxes Dry - glass, ONP, metal cans, some plastic cont.	3 stream with wet bag for compostables	181	Mar 92	993	520		284		94%	81%	30 day pilot Yard waste (not collected due to winter) added to compost. High degree of promotion to residents. Level of reject material in compost not indicated.	11 & 12
Hamilton, NY	pilot	Wet - food, soiled paper, paper pckg.	3 stream	150	Sep 92				54		83%			3
Kerkhoven, MN		Wet - Kitchen (incl meat/dairy), tissues, animal droppings, disp diapers, paper (soiled or not,exc ONP) Dry - BB	3 stream	250	1990				239		95%+		compostables are 64% of non recyclable stream	3
Lanesboro, MN		As above	3 stream	450	1989				236		95%+		compostables are 57% of non-recyclable stream	3
New York, NY	pilot	Wet - food, uncoated paper food pckg., yard	3 stream	3,700	Nov 91				425 - 475		not available		Little yard waste collected as predominantly multi-family. Participation difficult to measure as predominantly multi-family	3
Spring Valley, NY		As above	3 stream	1,000	1989				709		95%+		Half of waste collected is in compostable stream, one quarter in recyclable stream	3
Swift Co., MN		As above plus yard in wet str.	3 stream	2,300	May-90				not available		95%+			3
Santa Barbara, CA	pilot	compostable materials - details not available	not available	1,400	Apr 93	n/a					n/a	n/a		12
Lemsterland, Netherland	Full Scale	Wet - 1 for compostables (kitchen & yard - no meat) and another for other wet waste Dry - 1 for all fibres and another for plastic & metal containers	4 stream two, two-compart bins	4,500	May 91			289		321	very high compliance reported		Separate textile collection. Glass is taken to drop off centres - 1 per 520 res. Problems with contamination of container stream with fibres - unsure whether collection or source sep problem. Recovery data from 1991	13

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Collection

Each stream was collected using a separate collection vehicle. Those streams collected in plastic bags were collected using a one-side loading packer truck. Streams stored in bins were collected with a two-side loading packer truck, equipped with side-mounted hydraulic lifters.

Wet Waste Processing

Wet waste was composted at a 10/tonne/week plant located at the Guelph landfill. This plant was specifically constructed to handle the material generated through the demonstration project.

The facility is a hybrid, combining features of a static aerated pile and an in-vessel reactor. A range of experimental techniques were used to develop a method of removing plastic bags and other contaminants from the organic stream.

Findings

Findings available to date are as follows:

- while the clean organic and clean dry streams of a 3 stream system exhibited lower contamination rates, 58% of the material found in the garbage stream was either compostable (25%) or recyclable (33%);
- although the capture rate for compostable and recyclable material in a two stream system was higher than that found in a three stream system, materials recovered in the dry stream were more contaminated. This may have an affect on their marketability.

Diversion Rates

- Overall, results from the pilot study indicate that 60-70% of residential waste material could be diverted:

  — the 3 stream system diverted 61% from landfill
  — the 2 stream system diverted 69% from landfill.

Quality of Compost

- Finished compost produced from both streams was tested against MOEE interim guidelines published in November, 1991 (Laird, 1992). The 51-week averages consistently met those criteria against which it was tested. Testing against the full set of criteria was continuing. The results of tests against the full set of MOEE compost quality guidelines were not available at the time of preparing this document.

Quality of Dry Recyclables

- The 3 stream system produced a slightly higher quality of recyclable materials than the two stream system. In the 3 stream system, approximately 98.5% of materials were uncontaminated and marketable while in the 2 stream 92.5% were uncontaminated.

Bins vs. Bags

- 75% of the households using bins as collection containers found the wet/dry program to be more convenient whereas only 51% of those households using plastic bags found wet/dry to be convenient.

Future Plans

Due to the potential for higher recovery rates, lower estimated municipal and private sector costs, and improved program flexibility, the City of Guelph has decided to adopt the two stream approach for city-wide roll-out.

Guelph plans to utilize a two compartment vehicle to enable both wet and dry streams to be collected at the same time. Research is underway to develop a collection vehicle to suit these needs. Guelph is also investigating a hydraulic mechanism which incorporates a dynamic weigh-scale to allow for implementation of a direct cost system based on weight, not volume.

Certificates of Approval have been obtained from the Ministry of the Environment and Energy, though construction of the full scale facility for composting and for processing recyclables has not begun at the time of preparing this report. The organic waste facility is expected to be designed to handle all residential and most IC&I wet wastes.

City of Mississauga Pilot Project

Description of System

Launched in October 1991, source separated organics were initially collected from a high-rise building, kitchens of Mississauga General Hospital, and four garbage collection routes. A total of 3,000 households were involved in the demonstration project. An Executive Summary of the report on this pilot has been published (Proctor & Redfern, 1994).

The primary objective of the Mississauga wet/dry demonstration project was to test a variety of collection systems for source separated organic wastes and to try to identify which collection system might strike the best balance of cost effectiveness, convenience, potential for waste diversion and high compost quality (Proctor & Redfern, 1992a, 1993, 1994).

Four combinations of storage and collection systems were tested, including two 2-stream and two 3-stream systems.

A second objective was to demonstrate composting of food and yard wastes using outdoor turned windrow technology. The day-to-day operation of the site was contracted to Compost Management Associates and was similar to the system that was employed in the Halton demonstration project.

During the first year of operation, about 1,000 tonnes of organic material were collected within the various study areas and delivered to the site for composting. For the period from March to December, 1992, yard waste represented about 75% of the material collected at curbside (Nash, CMA, 1993).

Finished compost has been tested against and has met the Ministry of Environment Compost Quality Guidelines. Approximately 50 cu.m. of finished material was distributed at public giveaway days, another 150 cu.m. were used by the Mississauga Parks and Recreation department. About 300 cu.m. were sold to a local nursery for $3.00 a cubic meter (Nash, CMA, 1993).

Findings

Some of the findings from the first year of operation include (P&R, 1992a, 1993, Nash, CMA, 1993):

- no single collection approach was identified that seems ideal or suitable for recommendation for a city-wide roll-out;

Compost quality

- finished compost from the two-stream collection routes met MOEE guidelines for compost quality, but tended to be highly contaminated with inorganic contaminants, despite intensive hand-sorting of the incoming feed materials (this does not appear to be a sustainable approach to production of first-quality grade of compost);
- "sharps", including pieces of razor blades and hypodermic needles were found in screened finished compost from a 2 stream route. This indicates that screening alone cannot be counted on to recover all types of contamination.

In-house and curbside collection containers

- kraft/cellulose paper bags were preferable in the composting process because mechanical debagging technology is not yet available. The major disadvantages of using paper bags are that they are bulky in storage, have a high per unit cost, and effective methods to distribute them to residents have not yet been identified;
- in comparison, plastic bags are inexpensive, and easily available, although they pose considerable problems for debagging of materials;
- reusable containers work well, but residents need intensive education to prevent them from lining the containers with plastic bags.

Collection

- brush and Christmas trees should be collected separately from other organics because of the difficulty in separating this material from other organic wastes;
- it is best to start with a limited number of materials (e.g. yard and food waste), work out any problems and add more materials (e.g. paper products) gradually. Halton did this and had less problem with contamination than any other wet/dry program;
- the driver of the collection vehicle plays an essential role in rejecting bags that are extensively contaminated;
- collection contracts should be structured to reward contractors for hauling the maximum amount of clean organics to the composting site, and to discourage them from bringing in contaminated organics (e.g. the contractor should haul residue from the compost site and pay the city a weight-based residue penalty).

Diversion

- during the winter, the average daily receipt of waste was as low as 2 tonnes. During the spring, this rose to as high as 15 tonnes;
- available data indicate diversion rates of approximately 35% for the three-stream system and between 22% (not including recyclables) and 41% for the two-stream system. Diversion in some cases improved in 1993 over 1992, attributed to increased participation (Proctor and Redfern, 1994).
- recovery of organics for composting generally accounted for more than 50% of diversion achieved (Proctor & Redfern, 1994).

Residential promotion and education

- intensive promotion and education is needed to produce good, consistent and widespread participation (this is a problem inherent in all other wet/dry demonstrations) (Nash, CMA, 1993);
- participation rates tend to be about 50% and are not sustained (they drop after a period of time) (Nash, CMA, 1993);
- residents need some form of direct feedback, especially concerning contamination. The approach should be similar to leaving unacceptable materials behind in the recycling container with an explanatory note (Nash, CMA, 1993).

Region of Halton Pilot Project

Program Description

For an 18 month period, the Ministry of Environment, Region of Halton and the Town of Oakville sponsored a pilot wet/dry demonstration consisting of approximately 600 homes located in one neighbourhood in Oakville. The demonstration relied on a three-stream collection system, and was designed to gather information on the following:

- operational details of the three stream collection system;
- processing requirements for the materials collected in the dry stream;
- marketability of the processed dry materials; and
- the quality of the finished compost produced using residential feedstock.

Collection of the dry stream of the demonstration ran from June 1991, to June 1992. Collection of the wet stream continued until the end of October 1992 (Proctor & Redfern, 1992, Nash, CMA, 1993, Municipality of Halton, 1993). A final report on the pilot project has been published (Municipality of Halton, 1993)

Handling of Wet Wastes

Households were asked to store and set out organic waste in plastic bags. Small green tinted plastic bags were provided for fruit and vegetable scraps, while larger clear plastic bags were used for yard waste. Meat scraps, bones, food contaminated paper and diapers were not part of the organic stream, but were to be placed in the third "garbage" stream. Households in the study area were initially requested to only put out leaf and yard waste for compost collection. Non-meat kitchen wastes were added in October 1991.

Organics were collected with a side loading packer truck and were delivered to a temporary composting site located at the Region of Halton Sewage Sludge facility. Collected food and yard waste was composted using turned, outdoor windrow technology. Compost Management, contractors for the facility, used the Region's SCAT windrow turner to help remove the plastic bags. Plastic that was left after the SCAT machine had passed through the material was removed by hand.

Handling of Dry Recyclables

Residents were provided with large roll-out carts to store and set out the following recyclables, in addition to the traditional recyclable materials:

- rigid plastic containers;
- film plastics;
- polystyrene;
- aluminum foil;
- scrap metal;
- boxboard;
- fine paper;
- tetra paks;
- textiles.

Dry recyclables were collected using regular hydraulic side loading collection vehicles and were delivered to the Region of Halton facility for processing. Results of the dry recycling processing trials are summarized in Table E.1 (Mercer, 1993, Municipality of Halton, 1993, P&R, 1992).

Preliminary Findings

Based on a year of data, a diversion rate of approximately 58% was achieved through the Expanded Blue Box and composting collection streams as well as estimates for backyard composting. Of this total, 26% diversion was achieved through collection of dry recyclables, 25% diversion was achieved through curbside collection of compostables, and an estimated 7% diversion was achieved through backyard composting. This percentage is lower than the 71% that had been anticipated (P&R, 1992).

Data provided to RIS indicate that of all the waste collected at curbside, approximately 22% was diverted through the wet stream and 34% was diverted through the dry stream (when collecting expanded list of materials) (Municipality of Halton, 1993, Mercer, 1993).

The three stream curbside collection system was able to divert 85% of the available recyclable material and between 58% and 67% of the acceptable compostables (Municipality of Halton, 1993).

Metro Toronto Pilot Project

Description of System

Approximately 15,000 single family households, located in Etobicoke (2,600 in each of two areas), North York (8,000) and the City of Toronto (1,500) were involved in Metro Toronto's "Pilot Scale, Domestic Source Separated Organics Collection/Processing Project". These areas were assumed to be largely English-speaking to allow promotion materials in English only. Participants were asked to separate all non-liquid food scraps and trimmings, and all yard waste including brush and clippings less than 3 inches in diameter (Sims, Metro Works, 1993).

The overall goals of the demonstration were:

- to determine whether participation rates and quantities recovered are sufficient to justify widespread residential wet waste collection;
- to evaluate the ability of residents to put appropriate, uncontaminated wet waste out for collection, so that a usable product may be produced; and
- to identify an effective container system that encourages participation and allows participants to distinguish wet waste from garbage.

Food Waste Collection Systems

In-house collection containers that were tested include:

- a "kitchen catcher" unit which was used to hold green plastic bags (bags are also supplied); and
- a wire rack equipped with a lid, which was used to hold plastic grocery bags.

Plastic pails were used as outdoor containers, ranging in size from five gallons in one collection area, to 13 gallons in another. All organic material set out at the curb for collection was being picked up with either side loading or rear loading packer trucks.

Wet Waste Processing

Compostable material collected from the three collection areas was delivered to the former Experimental Resource Recovery Plant in Downsview, at the Dufferin Transfer Station site. It was composted using the Fairfield-Hardy digester unit that was already in place and was modified for this project.

Material was off-loaded from the packer trucks, and large bundles of brush were pulled from the piles, either manually or with a small skidsteer loader. The remaining material was loaded onto an incline conveyor which fed into a custom designed bag breaking machine. With the use of a trommel screen and a magnetic separator, oversized materials and other contaminants were separated from the rest of the organics.

The remaining material was transported to the digesting unit where it was processed for a period of seven days. At the end of that period, the partially composted material was discharged and transported to outdoor, aerated storage bunkers, where it was kept for about eight weeks, before being screened and moved to a curing pile.

Preliminary Findings

- Weekly set-out rates were low in the first few months, at approximately 30%;
- Of the households that were participating, generation rates were comparable to those found in the Guelph Wet/Dry demonstration (Nash, CMA, 1993).

Areas of Further Research

- The University of Guelph was conducting growth tests on some of the finished compost produced by the Metro Toronto program. The results of the tests were not available at the time of preparing this document;
- Attitudinal and participation studies have been conducted in each of the three study areas. The results were not available at the time of preparing this document;
- A comprehensive final report describing the results of all aspects of the demonstration is currently being compiled (Ariganello, 1993).

Gold River, British Columbia

Community Description

Gold River is located approximately 375 kilometers from Victoria, near the geographic centre of Vancouver Island. The population of Gold River is approximately 2,200 (1986 census) with 800 residential dwelling units (460 single family units, 180 mobile homes and 160 multi-family units).

Gold River is a relatively wealthy community, with an average household income of $45,000. Total employment in the Village is about 1,050 jobs. About 60% of this total are employed in the lumber industry (tree harvesting and a lumber mill). However the economic future of the community is uncertain as the mill recently laid-off 150 staff.

Waste Management Context

The Village is responsible for the collection and disposal of solid waste for all residents and the IC&I sector. In addition, the local mill disposes of its non-industrial waste at the Village landfill (the mill operates its own landfill for industrial waste disposal). Currently, there is no tipping fee for refuse disposal at the Village landfill .

The drive to implement a wet/dry program was the product of a convergence of environmental and political forces. The environmental pressure was based on the need to find additional landfill capacity. In 1990, with no diversion program, the existing landfill had an estimated 10 years of useful capacity. The Village applied to the BC Ministry of Environment (MOE) for a permit to site a new landfill or expand the current operation. The MOE indicated that no permits would be provided until the Village implemented a waste diversion program which demonstrated an effort to achieve the province's recently adopted 50% diversion target.

At approximately the same time, a group of local citizens were pressuring the local council to implement waste diversion. A wet /dry program was part of the list of options prepared by the Regional District and was selected for two main reasons:

- it provided the greatest potential for waste diversion;
- it was perceived as the most publicly acceptable form of residential waste diversion (in terms of the level of activity required by the residents).

Program Description

<u>Collection and Processing</u>

The collection fleet consists of several rear packer trucks. These vehicles are used to collect residential waste as well as material from the IC&I sector. IC&I locations are provided with two 2 cubic yard bulk lift bins, one for dry recyclables and one for organics. Residents use plastic bags to collect materials; a blue bag for dry recyclables and regular dark green bags for the organics fraction.

All materials are delivered to a processing centre located at the public works yard. The MRF is a fully enclosed 1,200 square metre building which houses all separation equipment and provides storage for baled materials. The processing centre consists of an in-ground conveyor (approximately 2 metres in length) which feeds material to an incline conveyor. The incline conveyor delivers bagged material to rotating carousel. Inside the carousel, two staff manually debag dry materials and complete the sorting process. (Bags used to be opened by hand but after a number of injuries, electric bag cutters were purchased.) Other processing equipment includes a skid steer loader to load bagged material onto the feed conveyor, a magnetic separator, a baler and a glass crusher.

Organic material is processed on the same line with a few additions. For example, a trommel screen (approximately 2 metres in length and 1.5 metres in diameter) is used to de-bag organic material. As required, the trommel screen is hydraulically positioned in front of the incline feed so that bagged material goes through the trommel before it is dropped on the carousel.

The compost pad is adjacent to the MRF. The 1,200 square metre pad consists of a pole barn structure which provides a roof for cover but is open on all sides. A wire fence was installed around the facility parameter to prevent bears from entering the composting area. The pad is made from concrete and is sloped to provide drainage for excess moisture. Liquids drain into the municipal sewer system and are treated in the sewage plant.

<u>Operation</u>

Residents are asked to separate their waste stream into dry and organic fractions for collection. A listing of the materials collected in each stream is provided in the table below. Each stream of material is collected by the municipality once per week. Residential dry waste is collected Mondays and organics on Tuesdays. IC&I waste is collected during the rest of the week.

Dry materials are collected in a transparent blue plastic bag which must be purchased by residents. Organics can be stored in regular garbage bags. The municipality also collects the same two streams from the IC&I sector. Each IC&I location is provided with two 2 cubic yard bins, one for each stream.

Residents and the IC&I sector are directed not to mix hazardous material with either the wet or dry fractions. Instead, residents and employers are asked to store these materials at their residence or business until a proper hazardous waste collection program can be developed. However, hazardous material does end up in either the dry or wet streams and is disposed at the Village landfill.

Table F.2
Gold River Material Sorting Requirements

Dry Waste	Wet Waste	Hazardous Waste
Paper (i.e. newspaper, boxboard and magazines **Glass** (i.e. rinsed bottles and jars and drinking glasses) **Metal** (i.e. food and beverage containers and aluminum foil **Plastic** (i.e. bags, containers and wrap) **Other Dry Waste** (i.e. clothing, juice containers, wood and milk cartons)	**Food Scraps** (i.e. bread, cheese, meats, vegetables, etc.) **Yard Waste** (i.e. brush, grass clippings and leaves) **Other Wet Waste** (i.e. ashes, disposable diapers, kitty litter and tissues)	aerosol spray cans ant traps anti-freeze batteries bleach brake fluid chemicals gasoline herbicides household cleaners insecticides light bulbs medicines motor oil nail polish oil filters paint paint thinners solvent syringes turpentine

At the MRF, recyclables are separated by hand into six different streams: old newspaper, glass, PET, natural HDPE and other plastics, and metal containers. The remaining blue bag material is diverted off the carousel through a cross belt magnetic separator and a shredder after which it is taken to the composting area.

ONP, PET and HDPE are baled and stored until sufficient quantity has been collected to justify a shipment to market. Other plastics are baled and landfilled. The market for glass in this area is not viable and therefore is used as cover at the landfill. Metal containers are hand-sorted by brand name and stored in clear plastics bags until a sufficient quantity has been collected for baling.

On the composting side, bagged material is passed through the trommel screen with blades. Waste less than three inches in size falls through the screen. This material is later collected shredded and composted. The remaining contents of the organics stream are conveyed to the carousel where recyclables and other non-compostable materials are removed by hand and a magnetic separator. Compostable material is shredded and sent to the storage area until enough material for a pile has been collected, which usually takes two weeks.

All composting is done using static piles and negative aeration. Building piles is a four step process:

- first, over-sized composted material (5/8 inch material which did not pass through the screening process from previous piles) is placed on the concrete pad to form the pile's bed;
- second, a perforated pipe - which is connected to a blower - is placed on the bed. The blower can push air into the pile or it can remove air;
- third, size-reduced organic material is piled approximately two metres high, two metres wide and four metres in length;
- fourth, the pile is covered with compost.

The pile is allowed to compost for about six weeks at an average temperature of 45°C to 60°C. During this period, oxygen is drawn out of the pile using the perforated pipe and blower. Negative aeration was found to produce a more constant temperature in the pile compared to forced aeration. After six weeks, the pile is turned and water is added as required. The pile is left to compost for another six weeks. Near the end of this cycle, air is pumped into the pile to help dry the material which is then screened again.

Finished compost is used by the municipality for various public works projects in the Village.

<u>Diversion</u>

Table F.3 summarizes the amount of waste handled and quantities diverted for 1993.

- The table shows that a total of 890 tonnes of municipal solid waste was collected by the Village in 1993. This total includes all residential and IC&I sources in the Village plus non-industrial waste generated by the local paper mill.

- Approximately 265 tonnes of waste was not processed at the Village processing centre was sent directly to landfill. The majority of this total is non-industrial waste from the local mill which does not participate in the wet/dry program; a small percentage is municipal solid waste from the Village which was landfilled when the processing centre was not operating because of mechanical breakdowns.

- A total of 630 tonnes of waste was sent to the processing centre in 1993. About 60% of this total, or 380 tonnes was wet waste. The remaining 40%, or 250 tonnes, was dry waste.

- Of the 630 tonnes processed at the MRF and compost facility, 110 tonnes were separated and landfilled.

- A total of 520 tonnes of waste was separated for recycling or composted. Therefore the rate of diversion in 1993 was 58%. Recovery rates for individual materials were not available.

Table F.3

Summary of 1993 Gold River Waste Generation and Diversion (tonnes)

Waste Collected	Direct to Landfill	Gross Dry Stream	Gross Wet Stream	Total Gross Wet/Dry	Wet/Dry Landfilled	Wet/Dry Diverted	Diversion of Wet/Dry System
890	265	250	380	630	110	520	80%
Source: Village of Gold River, April 1994.							

<u>Participation</u>

According to Village staff, an estimated 50% of households and IC&I locations regularly separate wet and dry waste into the correct fractions. For the remaining population, the contents of the wet stream tend to be contaminated with household hazardous goods and dry recyclables. The wet stream tends to be relatively more contaminated than the bag with dry recyclables. Village staff speculate that the reason for this difference is related to the types of bags used to collect materials. The dry stream is collected in a transparent bag; as a result contamination is relatively easy to see. In contrast, the wet stream is collected in a dark coloured bag which masks the contents of the bag until it is opened.

Another possible reason for the high rates of contamination is the lack of promotion and education support. During the first 12 months of start-up, a grant provided by Proctor and Gamble provided funds for a promotion and education program. However, after the grant period ended in August, 1993, council did not provide funds to continue the program which then had to be eliminated.

<u>Program Costs</u>

The capital cost of the Gold River wet dry program was $1.4 million. This total includes the cost of all processing equipment, the MRF building and compost pad. The community received a $300,000 grant from the province, and therefore was left with a net capital cost of $1.1 million. No additional collection equipment was required because the community uses its existing rear packer fleet.

Operating costs for the wet dry program in 1993 are outlined in Table F.4. The table shows that annual operating costs total $421,500. This total includes $360,400 in operation costs and $96,300 in annual capital costs. The total cost of the program on a per tonne basis is $473/tonne. The operating cost of the program is $365/tonne.

As there are no landfill tip fees, the entire cost of the program is paid through the local assessment.

Table F.4

1993 Wet/Dry Program Costs and Revenues

Operating Costs	
Wages	
Collection and Disposal	$99,800
Recycling and Composting	115,300
Benefits	37,700
Total Wages and Benefits	$252,800
Supplies and Materials	$10,200
Garbage Container Maintenance	7,400
Landfill Maintenance	19,000
Recycling Plant Services/Supplies	19,000
Composting Services/Supplies	7,800
Recycling Plant Heat and Electric	11,300
Consulting	19,400
Recycling Education	13,500
Gross Operating Costs	**$360,400**
Operating Grants (from Proctor and Gamble)	-35,200
Net Operating Costs	$325,200
Tonnes Collected	35,200
Operating Cost/Tonne	**$365**
Annual Capital Costs	
Annual Capital Cost for Processing Centre (capital amortized over 10 years)	$90,000
Interest on capital (7% per annum)*	6,300
Total Annual Capital Costs	96,300
Total Annual Expenses	**$421,500**
Annual Cost/Tonne	**$473**

*Interest paid by the Village on annual capital is a variable rate. For the purpose of this analysis, a 7% rate of interest has been assumed.

Program Assessment

The overall goal of the wet/dry program was to meet or exceed the province's 50% waste diversion goal. The target has been achieved with a 58% diversion rate for all waste (residential and IC&I) in 1993. The baseline for this measure is all municipal solid waste collected in 1993. The level of confidence in this weight is high as all waste is weighed on a scale before it is landfilled or enters the processing centre.

The success of this program is measured primarily by the level of diversion achieved. While program costs are a concern, they are not a barrier to the achievement of diversion targets. As stated by a Village staff person, "No matter what the cost or the problems, what counts is achieving something."

Overall, Village staff are satisfied with the way in which the program was implemented and operated. The MRF equipment is adequately sized to process the current volume of material. If additional processing capacity is required, this can be achieved by adding a third sorter to the current operation or extending the hours of operation.

However, according to Village staff, three main problems need to be resolved in order to improve the operational efficiency of the wet/dry program.

The first problem concerns promotion and education. Through the implementation process, staff have learned that a long-term commitment to on-going promotion and education is essential. For the Gold River program, this commitment was not obtained from council and it is believed that the current lack of promotional support has impacted directly on the degree to which residents regularly sort materials properly. This in turn has a direct impact on the cost of processing materials. The barrier to obtaining the local council's support for a part-time promotion program is money and perhaps a lack of understanding with respect to the importance of on-going promotion.

The second problem is household hazardous waste. Currently, the wet/dry program is not equipped to collect or store hazardous materials. Provincial commitments for regular collection days have not been realized and the community cannot afford to pay for these programs themselves. As a result, residents are asked to store these materials in their homes until a collection program can be funded. However, residents are mixing hazardous waste with the wet and dry streams, and this is eventually landfilled.

The final problem is identifying and securing markets for recyclables. The community is distant from viable markets and relatively high costs of transportation are incurred to ship materials to market. One possible solution which is currently being explored is the establishment of a marketing cooperative for all recycling programs on Vancouver Island.

A related issue is the quantity of plastic packaging material which currently have no market. In Gold River, the ratio between plastics which have no markets to those which are technically marketable is 6:1 by volume. The collection and processing of non-marketable plastic packaging is viewed as a significant problem in Gold River because it adds to the overall cost of the collection, processing and disposal operation.

In terms of future plans, the Gold River's Regional District is currently preparing a regional waste management plan. As a result, the future of the wet dry program is somewhat uncertain while the planning process is underway. However, two likely scenarios are that the Gold River landfill could be closed with its waste sent to another jurisdiction; in addition, the wet/dry plant could be processing material from other near-by communities.

Lemsterland, Netherlands

Lemsterland is a single municipality within the Dutch province of Friesland. It contains several small villages including the Town of Lemmer which is the largest. The recycling programme includes the entire municipality of Lemsterland, a significant part of which is rural. In total, there are about 12,000 people or about 4,500 households.

The regional waste management authority of Friesland is OLAP – it is responsible for the operation of the transfer station and the transportation of collected materials to their ultimate destination. All materials are delivered to the VAM in Wijster where there is a landfill, a MRF, a composting facility and where the construction of an incinerator is planned.

Material Collected

The Lemsterland programme addresses the full residential waste stream providing for the separate collection of ten categories of waste materials;

- PMD (plastics, metals and drink cartons);
- paper (newspaper, cardboard, magazines, and other household papers);
- organics (kitchen and garden materials but not meat waste);
- rest (non-recyclables and non-compostables);
- glass (some colour separation);
- textiles (old clothing);
- bulky wastes (large items such as refrigerators, ovens, beds, etc.);
- bulky garden wastes (tree stumps, bundled branches, etc.);
- household hazardous wastes;
- used motor oil.

Collection Method

PMD, paper, organics and rest:

The most significant feature of the Lemsterland collection programme is the utilization of the Double Dual Container system. Each household is provided with two (one green and one grey) 240 litre wheeled bins, both equipped with a fixed partition and hinged lid. Each compartment is equal in volume.

Residents are required to source separate their waste materials as follows: the grey bin is for the PMD and paper fractions. The green bin is for the organic and rest fractions. The set out of these bins occurs on alternate weeks. In other words, one week the green bin goes out; during the next week, the grey bin goes out. At both times, residents must place their bins at designated collection points marked on the sidewalk by a yellow square. Residents must retrieve the bins after they have been emptied. These bins vary in cost but are approximately $260 (Cdn) each.

One special dual compartment vehicle is used to collect the materials utilising one driver and two loaders. It is made by Geesink and costs about $450,000 (Cdn). The vehicle's collection chamber is horizontally split to match the wheeled bins. The truck can hoist and dump two bins at a time, spilling the contents of each bin compartment into its matching truck compartment. Collected materials are lightly "compacted" (however, the paper fraction does not "compact" well). The upper compartment is 12 cu. m while the lower is 8 cu. m. When the grey bins are collected, the paper fraction goes into the upper compartment while the PMD goes into the lower. When the green bins are collected, the organic fraction goes into the upper while the rest fraction going into the lower.

All 4,500 households are serviced in 4.5 days, Monday to Friday, which means that about 1,000 households are serviced each day. In the more urban areas (e.g. Lemmer), up to 1,500 households can be serviced. The truck must leave the collection route after 550-600 bins have been emptied (averages about 2 loads/day). When the grey bins are collected, it is usually the upper truck compartment containing the paper fraction which fills up first (thereby forcing the truck to empty both compartments at the transfer station – 5 minute drive north of Lemmer). The upper compartment may not be completely full since the paper fraction does not "compact" as well as the PMD.

With the green bins, the organic fraction usually fills its truck compartment first, but only during the summer (or garden maintenance) months. During the winter, the organics

compartment is often only half full when the truck must leave the route with a full lower compartment (the rest fraction).

Glass

Glass bottles and jars are collected via a dense drop-off (or bring) network involving single-chamber "igloos". Altogether, there are 23 drop-off sites with 41 individual igloos. The density of drop-off sites is therefore one per 520 inhabitants. Nine of the busier sites have three igloos each for the colour separation of the glass (white, green and brown). The busy sites are serviced two or more times per week. At less busy sites, glass is colour mixed in a single igloo. These sites are usually serviced at least once per week or may operate on an on-call basis.

Textiles

Textiles or old clothing is collected like glass. There are five steel bins that are serviced as required by a local charity organisation. They report monthly tonnages to the municipality.

Bulky wastes (non-organic and organic)

There are two separate bulky waste collections involving large household durable goods and large garden waste materials. Essentially, these waste materials cannot fit into the dual wheeled bins. Each household receives two bulky waste collections per month - the first may occur in the middle of the month for the bulky (non-organic) wastes and the second (large garden waste) may occur towards the end of the month. Plastic bags full of cut grass for example can be set out for the bulky garden waste collection rather than placed in the dual bin.

Household hazardous wastes

Each Lemsterland household is provided with a plastic storage box (most are 27 litre) for the containment of household hazardous materials (HHW). It is somewhat "child-proof". Every two months, two days are identified as curbside collection days. Residents who have materials to be collected must place a specially provided yellow card (30 by 20 cm) in a front window so that the collection vehicle can spot it. The "chemocar" driver must collect the HHW directly from each resident since it is against Dutch law to set such materials out at the kerb. Residents who are not home during the day can take advantage of drop-off or bring sites which are staffed specially designated times only.

The HHW collection programme is operated by a specialized firm (ATF) licensed to provide the service throughout Friesland. They actually use various collection vehicles which typically have six or seven compartments allowing the driver to sort the HHW into the appropriate containers.

Oil

Used motor oil can be deposited into specially provided igloos. The primary problem with this system is that these igloos are likely to overflow during the summer months since Lemmer in particular is a popular vacation destination for boating enthusiasts (they have 14 marinas and about 3,000 boat slips). To resolve this problem, the municipality has moved the five oil igloos from separate sites to one site which is located in the works yard where it can be supervised. Recovery levels will probably decrease.

Material Recovery Rates

Detailed material recovery data are available for the PMD, paper, organic, rest, and glass fractions. Household hazardous waste is reported to be about 20 tonnes/year. Bulky waste is about 1,000 tonnes/year. Roughly 30 tonnes of textiles are recovered annually. About 25 tonnes of oil were recovered in 1991.

Table F.5 presents material recovery data for the Double Dual Container and glass igloo systems; from the beginning of the programme in May 1991, through to the end of the year. During the first 20 weeks, the number of household served was 2,205. This increased to 4,526 for the remaining 13 weeks of 1991 (and up to the present).

Table F.5
Lemsterland Material Recovery – 1991 data

Material	Tonnes/year	kg/household/year
PMD	200	65
paper	597	136
organics	976	321
glass	258	88
TOTAL	**2,031**	**610**

A neighbouring municipality called Boarnsterhem with 7,000 households collects glass and paper once a week. No household container is provided and a custom designed, multi-container collection vehicle collects the material. Other materials including metals, HHW and textiles are collected on the fifth day using the same vehicle. Very approximate recovery figures are reported to be as follows:

Boarnsterham Material Recovery – 1991 data

Material	Tonnes/year	kg/household/year
paper	1,300	186
glass	450	64

It is interesting to note that Lemsterland collects more glass per inhabitant using a dense network of igloos than Boarnsterhem's weekly curbside collection system. On the other hand, the recovery of paper per household is lower.

Promotion

The sequence of promotional materials disseminated was as follows:

- an official letter announcing the programme;
- detailed calendar with sorting instructions;

- three newsletters over the first 12 months of the programme;
- periodic articles in a local newspaper.

However, the calendar with the detailed instructions is complicated and not useful as a quick reference guide. Also, stickers that are pasted on the outside of the bins would should be complemented by smaller, simpler stickers placed inside the individual bin compartments.

In order to enforce household source separation behaviour, the municipality utilizes a system of reminder cards. If a resident receives two cards, the municipality sends them a letter asking for their cooperation. If three cards are received, the municipality makes a telephone call to the non-complying resident. If a red card is received, the municipality will not collect from that household (there are about 7-8 such households). A visual inspection of full bins and of the actual collection procedure suggests that cards are handed out for gross infractions only.

Program Costs

The approximate cost of collection via the double dual container system is $175/tonne (Cdn). This cost figure apparently is all-inclusive, however, since certain parts of the programme have been subsidized the costs may be distorted.

The following costs are being incurred:

organics	$135/tonne (Cdn) (shipment + composting cost)
rest	$350/tonne (Cdn) (shipment plus landfill tip fee)
PMD	$80/tonne (Cdn) (shipment only, no processing cost during pilot)
paper	$40/tonne (Cdn) (shipment only, no processing cost during pilot)

The cost of waste management is paid for through local tax. This cost is actually hidden in the gas bill. Costs have risen dramatically over the past three years mostly as a result of the increase in landfill tip fees, and were:

1990	$235/household/year (Cdn)
1991	$400/household/year (Cdn)
1992	$407/household/year (Cdn)

With respect to the $160 (Cdn) increase from 1990 to 1991, $120 (Cdn) can be attributed to the rise in tip fees, with $40 (Cdn) attributed to the purchase of the truck and the double dual container system.

The collection of household hazardous waste costs the municipality about $135,600/year (Cdn). Collection costs for glass and textiles are covered by the private and non-profit organizations recovering those materials.

Problems Encountered

There are four major problems that have emerged as the programme has evolved: .

- contamination of the PMD fraction with paper - a quantity of paper materials in the PMD fraction has recently been identified as significant. While paper and glass fractions have shown a purity of 96% and 92% respectively, the PMD reached a recent low purity rating of 60-70% (that is, 30-40% of the material is not PMD). Reasons for this contamination are most likely a combination of (i) residents incorrectly sorting paper materials in the PMD compartment and/or (ii) at the point

of collection, the paper fraction is spilling into the lower (PMD) compartment of the truck;

- fly-blown plastics at the point of collection - because the Geesink truck hoists the wheeled bins about 4 metres high, the probability of wind lifting light plastic materials away from the truck is high. The Geesink "curtain" barriers on either side of the compartment openings have not contained the problem. Staff are currently experimenting with metal fitting around the openings to see if the problem can be resolved.

- dual bin compartments are possibly too narrow - programme operators have observed jamming of PMD and paper (especially cardboard) materials in the double dual containers. If the municipality could start again they would provide residents with 280 litre containers instead of 240 litre;

- cleaning of bins - this is the responsibility of residents. A private firm offered to provide a cleaning service for the municipality at $4.80/bin (Cdn) but this was considered too expensive. There have been some complaints about this since people either do not clean them (offensive odours) or they clean them in the street (rinse waste is poured into a sewer in front of the houses). Starting over, the municipality would have hidden the cleaning cost in the overall cost of the programme and residents would never have known.

District of Lunenburg, Nova Scotia

The Municipality of the District of Lunenburg and the towns of Bridgewater, Lunenburg, and Mahone Bay conducted a pilot Wet/Dry program from September, 1992 to mid-February, 1993.

A three-stream approach was adopted for the pilot program. It covered 982 households in all four municipalities. The wet stream included kitchen and yard waste. Roll-out carts (Compostainers) were provided for the organics stream. Blue Bags were used for commingled recyclables - tin and aluminum containers, glass, ONP, PET soft drink containers and plastic shopping bags. Weekly collection was provided in the towns and bi-weekly collection was provided in the rural areas at the same level of service as regular garbage collection (LURA Group, 1993).

A high participation rate was achieved. 70% of residents reported setting-out organics for curbside collection. 60% of those not using the carts reported using backyard composters instead. 90% of residents set-out recyclables in the Blue Bags at least monthly.

Contamination of recyclables was approximately 30%, mostly related to incorrect set-out of plastics. However, broken glass in newsprint was also a problem. The organics stream was reported to have little contamination.

Diversion of organics was reported to be 23% while diversion of dry recyclables (recorded only from mid-October to mid-December) was reported to be 7%. It was estimated that backyard composting diverted an additional 5% of the waste stream.

During the winter months waste generation was reduced. This was noted in all streams, particularly in the organics stream, due to lower yard waste generation. Freezing of organics in the roll-out carts was experienced but was not considered a problem during the course of the pilot.

From the surveys (three were conducted, at the beginning of the project, after phase 1 in the fall, and after phase 2 in the winter) high acceptance by participants was indicated. 85% reported that the program was "above average" while 2 in 3 residents preferred the system to regular garbage collection.

Other Projects

Table F.1 summarizes available data on a number of two, three and four stream wet/dry projects.

St. Thomas, Ontario, Pilot Program

Description of Program

During the spring of 1993, a curbside compost collection pilot was launched by the City of St. Thomas in co-operation with Green Lane Environmental and SSI Schaefer Canada. The purpose of the pilot was to test the viability and public acceptability of an organics collection system using a ventilated container called the "Compostainer".

About 1,200 households were involved with the pilot. Each household was given:

- a 64 gallon Schaefer compostainer;
- a kitchen counter bin and a sticker (to remind participants what was and was not acceptable in the program);
- an information package containing information on how the Compostainer worked, a brochure explaining the pilot program and the collection schedule, information on a workshop, helpful hints, and a telephone number in case participants had any questions.

A standard Shu Pack side loader equipped with a semi-automatic lifter was used to collect organics. The truck is operated by a one-person crew.

Organics were collected bi-weekly, and processed at an in-vessel facility.

Since the pilot, the program has been implemented city-wide. No results are available to date.

District of Giessen, Germany, Full Scale Program

Community Description

The District of Giessen is located near the centre of (former) West Germany. The District includes 18 municipalities of various sizes. The total population of the District is 230,000 (1991 data), with about 106,000 households.

Waste Management Context

The District is responsible for all waste management activities for the 18 municipalities. Many changes have occurred over the last twenty years, from municipal solid waste composting in the early 1970's to the implementation of the German Green Dot system in 1992 (private collection system for packaging waste). Residents of the District have been anti-incineration since the late 1980's, therefore there was a need to examine and implement other waste management alternatives. The District is currently achieving a 40% diversion rate (which includes 24% recycling, 18% composting, and 2% waste reduction and reuse).

Waste transportation and landfill tipping fees are currently over $300/tonne (Cdn).

Program description

The most widely promoted waste reduction initiative is home composting. About 10% of the District's households have become involved with home composting during the last five years.

A three bin system is used to collect recyclable paper, food and yard waste, and remaining waste. All material is collected by a private hauler as follows:

- a blue rollout cart (typically 240 litres) is used to collect specific residential fibres on a monthly basis using a rear packer collection vehicle with two cart lifters;
- household packaging that has been marked with the Green Dot -- e.g. boxboard, plastic bottles, etc., is collected every two weeks using large, yellow bags supplied to the householder. Bags are collected in a rear packer;
- a brown, ventilated rollout cart (typically 240 litres) is used to collect residential organics (food and yard waste) every two weeks using a rear packer collection vehicle equipped with two cart lifters. Carts are placed at the curb for collection. The first type of carts tested were unventilated, however there were many resident and driver complaints about odour.

Regular waste and organics are collected on alternating weeks. Organics are delivered to a centralized composting facility where they are placed in windrows. Organics are also collected from IC&I sources -- the material is kept in separate windrows because different management techniques are required.

Contamination levels for recyclable and organic materials is low -- about 3%.

The District also runs drop-off depots for glass containers located throughout the area. Drop-off depots are serviced weekly, except for some depots in high traffic areas which need more frequent servicing. Green Dot packaging is also collected at some depot locations.

The annual budget for the District is $16 million. Operating costs for residential organics collection and composting is $2,625,000. The District sells the compost and compost revenue is estimated at about 20% of composting operating costs.

Results

The following participation rates have been estimated for the program:

- 95% monthly residential fibre recycling participation;
- 60% participation for glass container drop-off;
- 80% participation for biweekly collection of residential organics.

Recovery rates for participating households have also been estimated. In general, the quantity of material recovered from households in the larger urban centres is higher than in smaller, more rural communities. The estimates for the City of Giessen are:

- 270 kg/hh/yr of food and yard waste/participating household;
- 200 kg/hh/yr of fibres/participating household;
- 70 kg/hh/yr of glass/participating household.

All residential waste management costs are paid by the taxpayer. On average, a household is charged about $200/yr (Cdn), or between $65 -75/person. The unit operating cost for the waste diversion program is estimated at $180-190/tonne (Cdn).

One issue the program has encountered is odours from the composting facility. Odours continue to be a problem during the summer months. Composting wet grass has caused the most problems and resulted in a temporary ban on the collection of grass during the summer of 1992.

Town of Markham, Ontario, Demonstration Program

In May 1994, Markham and the Ministry of Environment and Energy launched a "Model Community Demonstration Project" to test two new waste collection and recycling processing systems.

The community (including about 3,400 households) is divided into two areas. Residents in both areas will be able to recycle a wider range of materials.

The first area - the "Blue Bag Area" is testing a wet/dry collection system servicing 2,300 households. Residents and asked to separate their wastes into three streams including:

- expanded recyclables (placed in blue bags);
- compostables:
  - — leaf and yard waste (diverted either through backyard composters or curbside collection of plastic bags);
  - — kitchen waste that is diverted through backyard composters and other organic waste (meat, cheese, diapers, etc.) that is stored in plastic kitchen containers, then placed in blue boxes with lids at the curb for collection;
- garbage that is placed on the curb in a plastic bag.

A specially designed co-collection truck fueled with natural gas collects the garbage and compostable stream one week, and then the recyclable and compostable stream the next week. The truck has dual compartments with a total volume capacity of 56 cubic yards (18 cubic yard compartment for the kitchen and yard waste, and 38 cubic yard compartment for the recyclables and refuse). Both compartments allow for variable compaction rates, depending on the type of material collected.

The second area, the "Expanded Blue Box Area" includes 900 households. Residents in this area are also asked to separate their wastes into three streams including:

- recyclables which are placed in a blue box. Residents will receive an extra blue box to collect an expanded list of recyclables;
- leaf and yard waste are placed in a plastic bag and picked up at the curb;
- other waste which are placed at the curb in a plastic bag.

The expanded blue box items will be collected every other week by a specially designed truck with nine compartments.

The model demonstration project was started in early May. It is expected to achieve a 75% waste diversion and decrease processing and collection costs by about 30%. The project will run until April 1995. The results of the project are expected to be published after this period.

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SCHEDULE G

MIXED WASTE PROCESSING

SCHEDULE G — MIXED WASTE PROCESSING

Introduction

Mixed Solid Waste (MSW) processing involves collecting unseparated waste at the point of generation, and taking it all to a material processing facility. There, recyclable fractions are removed, processed and marketed, and the organic materials are composted. The residue is sent to landfill.

Some facilities focus particularly on composting while others focus on incineration. Some facilities also process sewage sludge with the mixed solid waste, a practice known as co-composting. A selection of case studies is presented at the end of this Section. A summary of selected programs is presented in Table G.1.

Benefits of Mixed Waste Composting

Proponents of mixed solid waste processing list the following benefits:

- **Simplicity of Collection**
  Waste can be collected in a single truck and does not require source separation. It might be expected that this should translate into cost savings, although this issue is subject to debate due to processing implications (Hammer, 1992).

- **Facility Requirements**
  Rather than having several different processing facilities, this is centralized into a single, co-ordinated venture, which is said to be easier to administer and operate.

- **Development of a Useful Product from Waste**
  Significant portions of waste are reduced in volume. Portions that are landfilled require less volume and help extend landfill life.

- **Increases Recycling**
  By removing the need for residential participation in source separation, and carrying out all separation at a centralized plant, some proponents argue that recovery of recyclables is increased. This too, is subject to debate (Lundell, 1992, Gitlin, 1992, Apotheker, 1991, Hammer, 1992).

Limitations of Mixed Waste Processing

The majority of mixed waste composting programs currently operating are experiencing a number of difficulties. Specific problems encountered by some facilities include the following:

Odour

Most mixed solid waste processing plants that compost organics at some time have been forced to counter odour problems. Odours at composting plants result from the biological activity associated with decomposition of organic materials. For some, such as the Portland, Oregon, Reidel facility, this was one of the factors which contributed to their closure (CMA, 1992, Goldstein, 1992, 1992a).

Table G.1
Summary of Selected Mixed Waste Processing Facilities

Facility Location	Start-up Date	Throughput (te/day) Curr	Des	Type of Waste	Compost Technology	Enclosed Composting	On-going Odour Problems	Capital Cost ($ million)	Operating Cost ($/year)	Comments
Coffeyville, KS	1991	73	73	Res/Comm	static pile, screen		No - isolated	not disclosed		Only 27 - 36 te/d composted; no presorting
Des Moines, IA	1991	175		Res/Comm	grind, ext. windrow, screen, encl. curing	√	Yes	5.85	not available	
Escambia, FL	Sep-91	228	228	Res/Comm	shred, windrow		No	not available		
Ferndale, WA	Jun-91		227	Res/Comm	digesters, screen, agitated bed, screen, air classifier	√	Yes	10.4	not available	Composting approx. 100 te/d; no markets for compost yet: 40% residuals
Fillmore Cty, MN	1987	27	23	Res/Comm	shred, windrow, screen, ext. curing		Yes - No major - frequent turning	1.91	390,000	covered pad under construction. Receive source separated res organics; 40% residuals.
Hidalgo Cty, TX	Feb-91	273	64	Res/Comm	shred, gyroscopic mill, windrow		No - isolated	1.95	146,000	Contamination a problem - considering additional pre-sorting equipment - $325,000. Also County begun collecting glass, rigid plastic and ONP
Lake of the Woods Cty, MN	1989	77		Res/Comm	shred, windrow, encl screen, encl curing	√	Some - isolated	0.78	338,000	use compost as landfill cover. 1992 BioCycle survey reports 5 tpd throughput
Lakeside, AZ	Aug-91	13	10	Res/Comm sludge	digester, aerated windrow, moisturize, screen	√	Yes	0.95	not available	compost sold as potting soil; 30% residuals but no market for recyclables
Moxa, MN	Jul-91	191	150	Res/Comm	shred, encl. static pile, screen, ext. curing	√	Some - fans/biofilter	14.3	1,690,000	high-tech sorting
Newcastle, DE	1984		205-R/C 205-S	Comm- 10% Sludge	shred, co-compost digesters, 25% cured/75% not	√	Yes	101.4	39,000,000	temporarily shut down due to odour. 50% compost marketed as topsoil, 50% as fertilizer
Pembroke Pines, FL	Sep-91	600	500	Res/Comm	aerated windrow, hammermill, screen, destone	√	Yes - biofilters problems, need additional aeration	63.1	not available	Currently class B compost; 20% residuals
Pennington Cty, MN	1985	70-75	36	Res/Comm	windrow,		N/A	1.69	not available	operating at 36 te/day; 10% residuals; 45% RDF
Portage, WI	1986	15	15	co-compost	co-compost in rotating drums, other compost	√	N/A	1.3	130,000	bulk of compost used as landfill cover; 20 - 25% residuals
Portland, OR	Apr-91	546	closed	Res/Comm sludge	windrow, encl. curing, screen	√	Yes	39	9,555,000	odour problems and costly retrofits caused bankruptcy
Sevierville, TN	Sep-92		136-R/C 22-S	Co-compost	digester, aerated windrows	√	Initially, resolved			Use large hoods over windrows; 20 - 25% residuals prior to screening
St. Cloud, MN	1988	91	45	Res/Comm	agitated bed, screen, destone, curing	√	Yes - wet scrubber, biofilter	48.75	1,300,000	165 te/d feed, 120 te/d to RDF, 45 te/d composted. Odour problems caused change from windrow to in-vessel
Sumter Cty, FL	1988	55-65	46	Res - 80% Comm - 20%	shred, windrow, screen		No - Very Rural	2.6	650,000	now only receiving 29 te/d as waste being taken elsewhere. 25% residuals
Swift Cty, MN	1990		11	Res/Comm	shred, aerated windrow, screen		Some	2.21	338,000	Erected hanger and purchased windrow turner - $425,000
Truman, MN	Aug-91	77	50	Res/Comm	shred, aerated/turned in-vessel, aerated static pile, grind, trommel	√	Yes - disguise with citrus oils	11.18	2,028,000	some concern re. PCB levels
Wright Cty, MN		109	100	Res - 60% Comm - 40%	aerated windrow			18 - 20		Operates at 82 te/day in winter. Receives source sep res organics + org. mtl from another facility. Compost used for Hwys/golf crs/cemeteries. Curbside recycling exists but still pulls recyclables. 35% residuals

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1. Data taken from 1. Compost Management, "Windrow or In-vessel: Costly High-tech Option Not Always Best Choice," in Ontario Recycling Update, Oct./Nov. 1992
   2. N. Goldstein, R. Steuteville, "Solid Waste Composting in the United States," BioCycle, Nov. 1992
   3. N. Goldstein, J. Glenn, "Solid Waste Composting Plants Face the Challenges," BioCycle, Nov. 1992
   4. N. Goldstein, J. Glenn, "MSW Composting Plants Learn from Experience," BioCycle, Dec. 1992
2. Costs presented in Cdn$ (reported in US$); throughput presented in tonne/day (reported in ton/day).
3. Additional data on Wright Cty facility: personal communication with Chuck Davis, Solid Waste Office, March and May, 1993
4. Additional data on Newcastle facility: personal communication with John Neyman and Rebecca Roe, Raytheon, March and April, 1993
5. Additional data on Sevierville : personal communication with J. DeMoll, General Manager, Sevierville, March, 1993

Notes:

1. Hidalgo operating cost based on $9/ton reported, 50 tpd throughput and assumed 250-day operation
2. Truman facility operating cost based on $72-75/ton reported, 85 tpd throughput, and assumed 250-day operation
3. Portland facility operating cost based on $49/ton reported, 600 tpd throughput and assumed 250-day operation

In some cases, with careful monitoring and improved operation, odours may be mitigated. As an example, the Columbia County, Wisconsin facility experienced odour complaints related to inadequate turning of piles, and the resulting anaerobic conditions. A new windrow turner was purchased to correct the problem (Goldstein, 1992). In other cases, expensive equipment has been required, which has not always solved the problem (CMA, 1992).

Contamination

MSW processing involves pulling off recyclables (either manually or mechanically) from other materials that must be landfilled, and then, sending the balance to the composting process. Contamination of finished compost is a problem. While plastics, paper and glass can often be screened out to a degree, other undesirable or toxic materials (either from household hazardous wastes or from other wastes) can stay in finished compost and cause quality problems.

Given the potential markets for compost (i.e. garden use etc.) it is critical that a safe and reliable product be generated. In the US, where guidelines are less stringent than in Canada (Hammer, 1992), several plants have still experienced difficulty with high contamination of composted material.

In Newcastle, Delaware, a new 1/4 inch screen is now used for all material that will be sold. However, to maintain throughput, only 25% of the material can be screened. The balance is used as landfill cover. Facilities in both St. Cloud, MN and Hidalgo, TE have had to redesign their process in response to contamination, including PCBs in the case of St. Cloud (Goldstein, 1992,1992a).

Quality of Recyclables

For a viable recycling strategy, secondary materials must be free of contamination, unbroken (in the case of glass), and easy to separate for processing. For this reason, recyclables recovered from a mixed waste stream produce secondary materials of a lower calibre. A US study showed that MSW facilities report lower recovery rates of materials than do source separation programs (Hammer, 1992). This is particularly true for paper fibres and glass.

The Columbia County, Wisconsin plant became fully operational in March, 1992. Despite recovery of recyclables by haulers who use the facility, a 40% material reject rate has been reported (Goldstein, 1992).

Cost

Municipal solid waste processing and composting plants are expensive to site and to operate. Operations demand a considerable amount of expensive technology and manpower, to ensure proper sorting of materials and management of composting. A US study showed that the average American MSW plant operates at a capital cost of $40,000US to $80,000US per ton of daily capacity (Apotheker, 1991a). Plants must be designed to accept and manage all of the waste generated in the community, rather than only a portion. This therefore requires, and a much larger facility.

Also, given the on-going operating problems experienced, and a general tendency to add capital improvements to solve the problems, costs can be become prohibitively high. Hidalgo County, Texas was investing an additional $250,000 in equipment to counter problems with plastic contaminants in the finished compost. The site was not fully functional, and markets for the material were not secured (Goldstein, 1992).

Market Development/Standards

While it can be difficult to market any type of compost, consumer acceptance of finished compost produced from a mixed waste stream is lower than acceptance of composted green waste, due to real or perceived quality differences (Hammer, 1992). A study completed in the Netherlands showed that farmers using mixed waste compost noticed a decline in sales (Segall, 1992). They also noticed a high level of residual contamination in fields (e.g. glass and plastic) following heavy rains.

Ferndale, WA was operating for approximately 18 months and had yet to market any material, as the compost was still undergoing testing, with process control adjustments being made (Goldstein, 1992a). The Columbia County, Wisconsin facility was landfilling its final product, pending state approval to undergo another two years testing of land application (Goldstein, 1992a).

Another approach to mixed solid waste processing involves separating combustable waste for processing into refuse-derived fuel (RDF) pellets. This approach is not addressed in the GTA 3Rs Analysis, as incineration of municipal solid waste is not permitted in Ontario.

Impact of Mixed Solid Waste Processing on Other 3Rs Activities

A system in which waste is collected in a mixed state for processing probably removes incentives to reduce, reuse and recycle. Individuals are not readily encouraged to take responsibility to reduce waste, either through buying recyclable containers, reusing materials (where possible) or reducing waste.

Municipalities are often required to commit to providing a certain amount of garbage to a facility or paying a penalty for the portion not delivered because mixed waste processing facilities are expensive to site and operate. Portland, Oregan was contactually obliged to pay for at least 185,000 tons of garbage per year for using the Riedel mixed waste processing facility (now closed) (Apotheker, 1991). These "put or pay" contracts can be disincentives for communities to encourage waste reduction.

Siting Facilities

Both Dade County, Florida (Agripost) and Portland, Oregon (Riedel) facilities were sited in locations arousing concern among residents which contributed to their closure. Other facilities near residential areas also have experienced complaints.

Applicability to GTA

At present the waste diversion potential of this strategy in the GTA context would be limited for the following reasons:

Contradicts Provincial Policy

- the mixed waste processing approach conflicts with the 3Rs focus of existing waste management policy and practice. The end-of-pipe strategy promotes an "out-of-sight, out-of-mind" attitude that would discourage 3Rs;

- Obligations to provide minimum quantities of waste to a mixed waste processing facility may be structural disincentives for communities to encourage waste reduction, contrary to the present approach in Ontario;

Erodes the Current Infrastructure

- the mixed waste processing approach would require dismantling of the current recycling infrastructure, which has been developed over several years and is at the point of operating effectively. This is considered a costly step backwards;

Quality of Materials Diverted

- Recyclables recovered from mixed waste programs require more effort and cost to process to a state suitable for marketing. The quality of recyclables diverted through source separation programs will always be higher than those which are mixed with other wastes, particularly wet organics.

- Finished compost is often contaminated with materials such as glass, plastic and household hazardous waste. This contamination is difficult and expensive to manage in a mixed waste processing and composting system. Compost quality is better controlled in a waste management system that includes source separation;

Case Studies

Examples of Successful Mixed Waste Composting Programs

A successful Mixed Waste Composting Program is defined, for the purpose of this study, as a program that has been operating at least one year, has had no unmanageable problems and is producing a compost that can be marketed (through free distribution or sales).

A telephone and literature survey showed that very few plants currently in operation should be termed an unqualified success. Most plants appear to be in a "grey area" where they have not yet demonstrated success and are experiencing on-going problems. Examples of current operations that are attempting to overcome difficulties are discussed below.

Wright County, Minnesota
(Goldstein, 1992a, Davis, Wright County, 1993)

The Wright County, MN mixed solid waste plant is relatively new, having started up in February, 1992. Capacity is 120 tons/day, averaging 90 tons/day in winter. In order to maintain a high organic supply, a trading arrangement has been struck where the neighbouring Anoka County provides required organic materials in exchange for receiving Wright County's plastic and paper materials for their RDF plant. Of incoming materials, 68% is estimated to be from residential sources, with the additional 32% from IC&I sources.

Finished compost is marketed to the State Highway Department and various golf courses and cemeteries. It is marketed as "Class A" unrestricted material, although some concerns with PCB content have been noted. This program utilizes an extensive sorting procedure (a combination of manual and mechanical techniques) which separates the aluminum, glass, newspaper and some plastic, OCC and magazines from the compostable materials. Approximately 8% of feed is recovered for recycling (steel, aluminum, OCC and PET), 36% is rejected, much of which is sent for incineration, and 58% is composted. Approximately 2% of finished compost is rejected.

New Castle, Delaware
(Goldstein, 1992, Neyman and Roe, Raytheon, 1993)

A public/private, in-vessel composting plant with a design capacity of 1,000 tons/day has been operated by Raytheon in Newcastle, Delaware since 1984. It was recently shut down

for retrofits. The plant was co-composting between 200 and 225 tons/day processed mixed solid waste with 100 to 150 wet tons/day of sewage sludge. The majority of incoming waste (up to an estimated 90%) is reportedly from residential sources.

Mixed solid waste feed is extensively sorted with a mechanical separator. Organics are processed in Fairfield digesters, and then cured in a large curing area. 25% of the approximately 250 tons/day output are screened (in a 1/4 inch screen) and distributed as compost. 75% of material is not screened (due to lack of screen capacity) and is utilized as landfill cover.

600 tons of the daily feed is sent to Pennsylvania for incineration, while 30 tons per day of steel are sold for reprocessing. It is anticipate that 3 to 4 tons of aluminum will also be recovered.

Compost has been marketable, selling at a cost of $4.50 per cubic yard (bulk) or $1 per 20 lb bag. Approximately 50% of the marketed material has been distributed as topsoil, and another 50% has been pelletized for fertilizer. The program has utilized advertising, public education, plant tours and other venues to distribute and create demand for the material. The Department of Transport was considering utilizing a significant amount of the compost in land reclamation and building projects.

The plant has experienced odour problems, contamination and other product specification problems (such as excessively dry compost). The potential for improved screening to reduce contamination was limited because this contributes to odour problems. It could only be done when the wind blew in a certain direction. Adding moisture to the piles also generated further odour problems. Odour complaints related to the digesters are being addressed (with consideration given to a new stack, fan, and neutralizing agents).

Pembroke Pines, Florida
(Goldstein, 1992 and 1993)

Pembroke Pines, a public/private venture, has been operational since October 1991. It is the largest MSW composting facility in the US, owned by Reuter Recycling. It currently processes 550 tons/day, or at about 80% of its design capacity of 660 tons/day.

A preprocessing stream separates 10% of material for recycling, another 20% for landfill, and the remaining 70% for composting. Ultimately, approximately one third of the incoming material becomes finished compost, which is currently distributed as Class B compost, and used in soil blends, on sod farms, and as top dressing. According to plant sources, virtually all compost is marketed.

The plant has experienced problems including:

- slow decomposition due to high temperatures caused by anaerobic conditions
- high equipment maintenance demands (parts of the hammermill are subject to wearing out)
- too little air in the piles between November and summer. This is due to a structural/engineering problem that has set the aeration below the groundwater. During these months, composting is halted;
- A major reconstruction project is being planned to fix the biofilter process.

With a secondary curing pad and reconstruction, plant representatives believe a Class A compost rating could be achieved (as the product cures longer and achieves greater stability).

Sevierville, Tennessee
(Goldstein, 1992a, DeMoll, 1993)

The Sevierville, Tennessee facility began operation in September, 1992 and appears to have built on lessons from preceding experiences in MSW composting (Goldstein, 1993). It is discussed here briefly because of its early successes.

The plant is built to a design capacity of 160 tons/day, of which 75% is collected from the IC&I sector, and 25% is residential. OCC is source separated and does not enter this stream. Organic materials are co-composted with 25 tons/day sewage sludge. Large items are manually separated at the front end (bicycles, tires, etc.) and all other materials are sent to the digester. Ferrous is separated with a magnet, and an aluminum separator was to be installed.

Prior to composting, 35% of incoming material is landfilled, 3 to 4% of the incoming stream which is ferrous material is recovered and an additional 2% is aluminum and was expected to be separated as well. The remainder is co-composted. Currently, 10% of the finished material is required for landfill cover. Most of the remainder, which is a Class A (Agricultural Grade) compost is given away to residents or sold in bulk to landscapers or soil mixers (DeMoll, 1993).

Examples of Failed Mixed Waste Composting Programs

Portland, Oregon
(Reid, 1993, McConaghy, 1993, Apotheker, 1991)

The Portland (Riedel) mixed solid waste composting plant was designed to accept approximately 600 tons of mixed municipal solid waste per day, and to convert 60% of that to compost. The facility, which opened in 1991, was the first large-scale mixed solid waste compost plant in the US. It was closed at the end of 1992 because the company was unable to provide the financial resources required to obtain the technology to mitigate odour problems.

The odour problems began at the outset, when the company accelerated the start-up process. Large quantities of material were accepted at the plant, before adequate time had been spent on slowly getting the composting process up to speed which is essential at the beginning of a complex biological and technological process. From that point, odour concerns were never properly controlled.

Also, the operation experienced difficulty meeting its contract commitment of recovering 5% of material for recycling, including successful marketing of the materials (Apotheker, 1991).

It should be noted that other technical problems had been experienced that are attributed to applying the wrong technology to this particular waste stream. For instance, plastic materials processed in the drums became mangled and twisted into plastic "snakes," which caused mechanical problems and additional wear on the machinery.

Dade County, Florida
(Libbey, 1991)

Siting for the Agripost, Dade County, FLA mixed waste composting plant was approved in 1988. In May, 1991, the facility was closed. The former Chief Operating Officer of the plant attributes its demise to a combination of political, financial and technical issues.

The facility was built on a small capital budget based on projected financial statements. This budget pivoted on a low county tipping fee and was barely adequate to sustain the facility. There was insufficient capital to permit facility officials to address technical problems and project financing did not accommodate the uncertainties inherent in a pioneer project. This demanded almost immediate full capacity functioning of the plant (at a large design capacity of 800 tons/day).

Accelerated start-up and weather conditions exacerbated odour problems. These are likely to have been compounded by new cell development at the landfill next door. Situated across the street from an elementary school and surrounded by a residential community, the operation had little flexibility. Agripost officials failed to win public opinion.

While Agripost did market finished material, the actual output of compost was slow. Partially finished compost was stockpiled, awaiting finishing in the trommel screen. Expensive retrofit equipment was needed to address technical problems (trommel screening equipment, new design for comprehensive duct work system to process air from the building, biological filtration and chemical scrubbing) but financing to complete the retrofits was difficult to obtain.

Attempts were made to obtain retrofit financing from lending institutions (contingent upon a favourable political decision regarding the county tipping fee) at the same time as the facility was brought before County Commission Hearings about health and safety. A decision was made to close the plant.

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SCHEDULE H

MARKETS

H1.0 OVERVIEW OF MARKETS

H1.1 Introduction

Each of the alternative systems described in the EA Input Document and related Appendices are founded on the assumption that markets for the materials diverted for recycling will be developed over time, in order that demand (for increasing amounts of recyclables that will be generated) keep pace with supply. Markets are not uniformly strong for all materials at this time. Markets for recyclable materials have developed unevenly, to a point where they are strong for some materials and quite weak for others.

Technological, economic and material quality issues related to collection and processing of recyclable materials influence their value and utility to end markets. For example, with plastics recycling, material identification and contamination has long been an impediment to more effective recycling. It has been expensive and difficult to sort materials to the specifications required to provide high quality feedstocks for remanufacturing. However, like many technical issues, this one is presently under study and various groups and organizations are dedicating resources to its solution, with increasing success.

This schedule presents a situational analysis, material by material, that realistically examines the current status of markets for materials that might be generated and recovered in the GTA. It discusses issues that have inhibited growth of markets or encouraged further demand. Based on information that is currently available, it presents a discussion of future trends that are likely to impact on material markets over the life of the study.

In recognition that existing barriers to finding and developing markets for recycled materials must be also be overcome, Section 8.0 of this schedule focuses on policies which may promote market development. Some of these include procurement policies that favour recycled content, policies that mandate minimum recycled content requirements, provide for tradable recycling credits and/or remove subsidies on virgin materials. A combination of any of these and more market development initiatives can help create an environment where demand for recycled materials would increase, thus supporting waste diversion. Market development policies, how they work, current examples and their potential impacts are also discussed in the final section of this schedule.

H2.0 MARKETS FOR FIBRES

H2.1 Introduction

The secondary fibre market in North America has been experiencing a glut of paper fibres created by several recent concurrent events, some of which include:

- the rapid implementation of curbside and office paper recovery programs;
- landfill bans prohibiting the disposal of OCC and/or fine paper;
- the recent introduction of mandatory source separation programs in several North American jurisdictions.

North American mills that produce newsprint, printing and writing paper, have responded to these forces by installing de-inking capacity to utilize secondary fibres. The Ontario market has proven fairly stable since Ontario-based mills generate ample demand for all secondary fibres collected through Ontario recycling programs. Over the long-term, the current glut of secondary fibre in the North American market is anticipated to fall short of market demand.

A new pressure for Ontario mills is the competition for sources of inexpensive secondary fibres. In the past, for example, manufacturing a material like boxboard used about 45% of recovered ONP. However, now other manufacturers are competing for ONP, in order to feed new ONP and OMG de-inking mills (Slack, Sonoco). Consequently, other cheaper fibres are being substituted in the place of ONP for boxboard. This trend has led to an unstable situation for some recycling companies and brokers, resulting in price fluctuations for substitute feedstock material, such as OCC, mixed paper, and ONP which are often interchangeable.

Fibre export is another important factor that affects Ontario markets. Over the years, exports of secondary fibre from North America have played a major role in the fibre market. Countries such as Korea, Taiwan, and Mexico which are fibre-short, value the North American recovered papers because they contain predominantly high quality primary fibres. As the North American paper mills continue to expand secondary fibre production, paper brokers are pressured to maintain a secure and growing supply of secondary fibres for North American markets, at the expense of the export market.

The marketplace for fibres is therefore dynamic. Prices for most paper grades are expected to increase over time with an increase in demand resulting from new mills and greater de-inking capacity. Changes in prices, supply and demand will continue to affect the overall market and the individual markets for specific types of secondary fibres. As new capacity to use recovered fibre increases, and as programs increase their recovery of these materials, markets will continue to change.

H2.2 Markets for Old Newspapers (ONP)

Canada is a world leading exporter of newsprint. International consumption and demand related to newsprint impact greatly on the industry. An average of 87% of Canadian newsprint was exported in 1991, 64% of which was shipped to the United States. Domestic consumption of ONP by Canadian newsprint mills accounted for only 14% of the total production (CPPA, 1991).

The recent demand for recycled content in newsprint in the United States has changed Ontario newsprint mills from small consumers of ONP (prior to 1991), to major importers in 1992. This trend will continue in the future as Ontario mills will need to look far beyond the Ontario market for sources of ONP.

Over the past decade ONP has become one of the most highly recycled post-consumer fibres in Canada with an estimated 40% of the available ONP collected in 1991 through a variety of recycling programs operating in Canada (CDNA, 1992). More than 50% of available supply was recovered in Ontario. Over the next few years, with new recycling programs targeted at the residential sector and the IC&I sector it is anticipated that the majority of available ONP will be captured in Canada.

Definition
Old newspapers are generated by the residential sector and the printing/publishing sector in the form of over issues. Grades of ONP vary according to the level of contamination and are defined by the Institute of Scrap Recycling Industries as #6 – News (typically collected in the residential curbside/depot collection programs); #7 – Special News; #8 – Special News De-Ink Quality (cannot contain any prohibited materials such as magazines, glossy inserts, staples, etc.) (ISRI, 1991).

Historical ONP Market Overview
ONP has long been collected from publishers' pressrooms (referred to as over issue news) and from newsstands (in the form of unsold copies). Typical end uses for ONP by mills included:

- containerboard;
- boxboard;
- molded pulp.

The use of ONP in the production of newsprint was not previously encouraged since only Grade #8 – ONP (containing very low levels of contaminants) could be used by mills. In early recycling, newsprint mills could accommodate only minute levels of contamination (i.e., magazines, glossy inserts, staples, flyers). Other paper production processes, such as boxboard, molded pulp products, and construction board could handle lower grades of newsprint with a higher level of contaminants.

Between 1982 and 1991, only one de-inking mill, owned and operated by QUNO (formally Quebec and Ontario Paper Co.) operated in Ontario. Three major factors have helped change this, including:

- the recent introduction of U.S. legislation requiring increased recycled content in newspapers which has had a profound effect on the demand for ONP by newsprint mills located in Canada and, to a lesser extent, the United States
- increased curbside programs collecting ONP;
- the City of Toronto requirement establishing minimum recycled content targets:
  - — 15% recycled content of newspapers sold in vending machines by June 1, 1993;
  - — 20% by June 1, 1994;
  - — 30% by June 1, 1995;
  - — 40% by June 1, 2000 (*Ontario Recycling Update*, March. 1992).

In response to these developments, the Canadian newsprint industry has invested an estimated $1.2 billion to develop de-inking technology (CDNA, 1992).

Current ONP Market Overview
The rapid progress in bringing Canadian de-inking mills on-line has resulted in increased demand for ONP as a feedstock in the production of newsprint. Additional end uses for ONP include paperboard (i.e. boxboard linerboard), construction board and material, molded pulp products (i.e. egg cartons, and plant bedding pots) and tissue products. Current use of ONP in secondary applications is estimated as follows:

- Newsprint 44%
- Boxboard 43%
- Construction Board and Materials 7%
- Molded Pulp Products 7%
- Tissue Products, Animal Bedding and Fine Papers >1%(GVRD, 1993).

The demand for ONP by Canadian newsprint mills has significantly increased since 1991 (when demand was 0.5 million tonnes). In 1992, demand for ONP increased to 1.2 million tonnes, and in 1993, demand was expected to increase to 1.3 million tonnes. Canadian residential curbside recycling programs recovered approximately 583,200 tonnes of ONP in 1992, falling short of demand by Canadian mills by more than half. With new recycling programs targeting both the residential and IC&I sectors over the next few years, an overall recovery rate of about 60% is considered feasible by the Canadian Daily Newspaper Association (CDNA) (CDNA, June 1992).

Since 1991, five newsprint mills have developed operations that use ONP. These are presented in Table H2.1.

According to the Newspaper Publishers of Ontario demand by Ontario newspaper mills reached 500,000 tonnes in 1993, exceeding supply by about 100,000 tonnes. The shortfall was made up by imports from the U.S. (*Recycling Canada*, December, 1993).

Table H2.1
Ontario Newsprint Mills with Recycled ONP Capacity

Company	1993 Estimated Annual Newsprint Capacity (000's tonnes)	Recycled Content	1993 Estimated Demand for Recyclable Paper (000's tonnes)
QUNO (Thorold)	340	70%	275
Atlantic Packaging (Whitby)	135	100%	160
Spruce Falls (Kapuskasing)	245	10%	30
Abitibi Price (Iroquois Falls)	–	15-20%	43
Abitibi Price (Fort William)	–	15-20%	18
CPFP* (Thunder Bay)	450	20%	120
		Total Demand	**646**

*CPFP-Canadian Pacific Forest Products

Sources: CPPA, 1993

Note: CPFP in Gatineau, Quebec is also a significant user of Ontario ONP.

ONP Prices
ONP prices remained stable at $40 to $50/tonne during the mid 1980s. From 1988 to 1990, prices dropped to $0 to $30/tonne (OPPUG, 1992). By 1990, the QUNO paper strike had forced recycling programs to find alternate markets. The majority of these markets were found overseas, and during this time many brokers received nominal revenue for the material.

Prices have increased recently as a result of heightened demand from the new de-inking plants. The 1992, Ontario market price for ONP ranged from $10 to $35 per tonne. Some forecasts suggest an increase in the ONP price to a level of $50 to $60 per tonne in the foreseeable future.

Diversion Trends
Ontario newspaper publishers have made efforts to reduce consumption of newsprint through light weighting, and other activities. Since 1989, total newsprint consumption in Ontario has declined by 31%, as a result of smaller newspaper sizes, a shift to lighter weight newsprint, reduced advertising and reduced readership (OPPUG, 1992). An estimated 10% reduction in consumption by the Toronto dailies occurred between 1990 to 1991. In addition, the move by the Toronto Star to a new press plant and a smaller newspaper format is expected to significantly reduce newsprint used by the Star, the largest daily newspaper in the GTA. Toronto papers are also beginning to purchase newsprint with recycled content, partly resulting from a City of Toronto bylaw requiring recycled content in newspapers sold in vending machines.

Market Development and Future Market Trends For ONP
The newsprint industry is anticipated to remain the major market for ONP in the future. Only modest increases in the use of ONP for other paper and non-paper applications are predicted. The Newspaper Publishers of Ontario report that a series of advertisements is being run in their papers to explain the environmental and economic value of recycling to readers (*Recycling Canada*, December, 1993).

Domestic markets have sufficient capacity to absorb all available ONP collected in Ontario. In fact, Ontario mills are expected to face a shortage of ONP supply as the demand for recycled content in newsprint continues to drive the newspaper industry in the United States (Johnson, QUNO).

While the Canadian industry as a whole is expected to reach only a 20% average level of recycled content by the end of 1994 (CDNA), it should be noted that the QUNO plant in Thorold, Ontario has successfully produced newsprint with 62% recycled content (GVRD, 1993).

Alternative end markets for ONP include construction board and material, molded pulp products, tissue products, cat litter and industrial absorbents, packaging and use of shredded ONP as animal bedding.

Market Outlook for GTA Generated ONP
It is anticipated that markets for ONP recovered in GTA will be stable for the foreseeable future, and capable of utilizing all ONP collected in the region.

H2.3 Markets for Old Corrugated Cardboard (OCC)

Introduction
Clean, non wet-strength, old corrugated cardboard is reported to have one of the highest product recovery rates (primarily through the IC&I sector) (Apotheker, March 1993). Part of the reason for the high recovery rate of OCC is it's concentration in large amounts from readily accessible sources. A recent U.S. study by Andover International Associates (AIA, 1993)

indicated that 50% of OCC is found in retail and commercial establishments (with an additional 28% in the manufacturing sector, 13% residential, and 8% pre-consumer off cuts). Further research indicates that 70% of OCC captured from the retail/commercial sector comes from large generators. For example, one case study showed that five large retailers in the U.S. alone recover nearly 1 million tons (0.9 million tonnes) of OCC annually (Watson, March 1993).

Definition
The OCC grade of waste paper primarily consists of used corrugated boxes. According to the Institute of Scrap Recycling Industries, OCC Grade #11 may consist of baled corrugated containers having liners of either test liner, jute or kraft. Prohibited materials may not exceed 1% and total outthrows may not exceed 5%. Pre-consumer double-lined kraft corrugated cuttings (DLK) is a separate grade of OCC (Grade #13) but this grade is often included in OCC recovery estimates (averaging up to 8% of total containerboard production in the United States) (ISRI, 1991).

Historical OCC Market Overview
OCC generated by the IC&I sector has been recycled by established markets for many years. Large grocery distributors, such as A&P and Loblaws, have been collecting and baling OCC for the past 20 years.

OCC is high quality fibre and traditionally has been recycled into boxboard and containerboard, including linerboard (the outer face of new corrugated boxes), corrugated medium (center fluting of a corrugated box), chipboard (the filler materials for solid fibre board) and, to a lesser extent, paperboard. These consume over 90% of OCC. Despite the recent interest by the fibre market in increasing the amount of secondary fibres in the fibre feedstock at the mills, the containerboard and boxboard industry has used post- and pre-consumer materials for the past couple of decades. Relatively clean OCC (without wax or coatings) can be directly introduced in the pulping process for containerboard and boxboard production, with no prior processing or de-inking.

The majority of containerboard mills have been situated in the eastern region of Canada, particularly Ontario, Quebec, and New Brunswick. This trend is expected to continue. Consumption of OCC by Canadian mills has increased over the years from 327,000 tonnes in 1975 to 948,000 tonnes in 1991 (CPPA, 1991). In 1988, approximately 70% of OCC consumption in Canada was used in the production of containerboard; the remaining 30% of OCC was used in the production of boxboard (MOE, 1993).

Current OCC Market Overview
OCC remains one of the easiest materials to recover since it is obtainable in a clean, dry form from the IC&I sector. The Paper and Paperboard Packaging Environmental Council (PPEC) estimates that the IC&I sector generates 80% of the available corrugated container material (PPEC, 1992). Municipalities have begun to capitalize on the high visibility of OCC in the IC&I waste stream by enacting OCC bans at local landfills. This initiative has helped to achieve high recovery rates for OCC in excess of 50% for many jurisdictions. According to NAPP (1992), the recycling rate achieved for OCC by the Ontario IC&I sector exceeded 60%. Increased volumes of available OCC are also likely to be seen due to the new Ontario 3Rs Regulations. A total of 9 sectors will be required to source separate OCC for recycling under these regulations (MOEE, October, 1993).

Table H2.2 identifies the prevalent containerboard mills in Ontario and their consumption of OCC in 1992. The Sonoco and Domtar owned mills produce 100% recycled content containerboard products.

Table H2.2
Ontario Mills Producing Recycled Content Containerboard

Mill	Location	OCC Demand (tonnes)
Sonoco	Brantford	30,000
Sonoco	Trenton	48,000
Atlantic Packaging	Scarborough	96,000
Domtar	Mississauga	68,000
Domtar	Trenton	68,000
MacMillan Bloedel	Sturgeon Falls	104,000
(References: Maryanne Christie, Sonoco, Jeff Remouche, Domtar and Bob Nelson, Atlantic Packaging, February to March, 1993).		

Two new major expansions of capacity will add to the Ontario market for OCC. These are:

- Domtar in Cornwall (Ontario) with a projected annual capacity of 120,000 tonnes; and
- Domtar in Windsor (Quebec) with a projected annual capacity of 240,000 tonnes.

Other end uses of OCC include the manufacturing of kraft paper; tubes and core board used by manufacturers of tissue, toweling, giftwrap, textiles, etc.; gypsum wallboard liner and roofing felt used in home renovation and building; packaging materials used for the shipping and sale of breakable objects such as fluorescent light bulbs, china, etc. and heavy objects; and flowerpots and biodegradable gardening supplies used by greenhouses and garden supply outlets.

OCC Market Prices
In the mid to late 1980s the price for OCC paid by Ontario mills ranged between \$60 to \$80 per tonne. Since then the prices have plummeted to lows of \$15 tonne and averaged \$25 to \$35 per tonne in 1993 (Remouche, Domtar).

The industry projects a modest increase in the price of OCC in the mid 1990s with a corresponding increase in demand (Apotheker, April 1992, March 1993). However, some volatility in prices is expected over the short period due to the low prices for other substitute fibres, such as ONP and mixed paper. The export market for OCC is expected to remain depressed due to the oversupply situation in Europe. These factors may create short-term fluctuations in the price until the market begins to stabilize (*Resource Recycling*, April 1993).

Diversion Trends
Several source reduction initiatives are underway in the IC&I sector to reduce OCC consumption. For example, the Railways Association of Canada approved package weight reductions of 5% to 10% for shipping purposes. This is projected to result in reductions of up to 100,000 tonnes annually in the amount of OCC used for transportation purposes in Canada (*Recycling Canada*, August 1992).

Cardboard container reuse systems are also being implemented by large and small companies. For example, Xerox Corporation has implemented a cardboard box reuse system and requires that its suppliers use any one of eight standard sized boxes to ship components. When shipments are received, a local distributor sorts and resells the boxes to Xerox suppliers.

Market Development and Future Market Trends For OCC
As an international commodity, OCC is strongly affected by national and international trends and developments, such as new market development, mandatory source separation programs, landfill bans, and recycled content legislation.

OCC currently has an established market in Ontario which is capable of absorbing more domestic OCC than is collected. At this time, 20% of OCC used in Ontario mills is imported (MOEE, October, 1993) and Ontario OCC competes with imported supply which has an established customer base. Depending on transportation costs and prices, some southeast mills (Florida, Kentucky, Georgia) may begin to capture some of the U.S. OCC now being shipped into Canada, thus increasing Canadian mill demand for local OCC.

New markets are also developing for OCC. Domtar has developed a revolutionary process to manufacture fine paper (a high value-added product) from OCC. This new technology should be in place by April, 1994 (Remouche, Domtar, March 1994) in Domtar's Cornwall plant, with a second plant in Windsor, Quebec coming on line by 1996. Rather than de-inking recycled pulp, OCC will be used directly in the production of fine paper. (McKanna, February 1993).

Waxed, coated, wet or organically stained OCC has not traditionally been recycled by most mills. It is generated in large volumes from a small set of users in the fruit, vegetable and meat processing businesses. Recently, several projects have been initiated to deal with waxed corrugated cardboard. One commercial compost site in Ontario has received a Certificate of Approval to compost waxed corrugate. Results of waxed OCC composting trials sponsored by PPEC have proven successful. In addition, efforts are underway to develop technology to remove the wax coating from the OCC for use in the production of new containerboard. Research is also underway in Scandinavia to develop a viable repulping process for waxed boxes (Apotheker, March 1993).

Market Outlook For GTA Collected OCC
The recovery rates for OCC across North America have increased, due to increasing disposal fees, and landfill material bans (Apotheker, March, 1992). Since OCC collection has become well-established in much of the IC&I sector, the opportunities to increase recovery lie in improving capture rates in the residential sector and penetration of the large number of smaller IC&I generators who do not currently recycle.

With significant increases in demand for OCC from mills in Ontario and Quebec, there is adequate market capacity to absorb OCC collected within the GTA. Composting of waxed corrugated has proven successful at the research level and it is expected that this may provide a further outlet for some of the waxed OCC generated.

H2.4 Markets for Boxboard

Introduction
In 1991, Canadian mills produced 826,000 tonnes of boxboard (OBB) for Canadian and international consumption (data provided by the Canadian Pulp and Paper Association.) Based on shipment data, the Paperboard Packaging Environmental Council (PPEC) estimates that 256,000 tonnes of boxboard were consumed in Ontario in 1992; the majority, (about 175,000 tonnes) in the residential sector.

Definition
Boxboard is a general term describing a range of paperboard products including folding cartons, setup boxes, and foodboard.

Historical Boxboard Market Overview
Traditionally, boxboard has been made with recycled fibre including:

- ONP;
- OCC;
- mixed paper.

Post-consumer boxboard itself has not typically been used as a source of fibre due to the high level of contamination by glues, plastics, and liners. Only recently has it been introduced as feedstock material. Virgin pulp is often added to the mixture to provide additional strength and integrity to the product.

The actual composition of boxboard varies considerably, depending on the price for the secondary feedstock and the availability. Consequently, there is no common "recipe" for boxboard production. According to Franklin and Associates (1991), a common composition for boxboard (in 1990) consisted of the following materials:

corrugated cardboard	45%;
mixed papers	22%;
newspapers	20%;
pulp substitutes	10%;
de-inking	2%.

Current Markets for Post-Consumer Boxboard
Mills have traditionally required post-consumer materials to be of high quality. The introduction of front-end cleaning equipment has permitted existing boxboard mills to remove glues, coatings and other contaminants found in bales of post-consumer boxboard. PPEC is currently also working with package designers and adhesive manufacturers to reduce the use of materials which become contaminants in the recycling process. This has effectively reduced a major barrier to material utilization and market development.

Two Ontario boxboard mills (Cascades Paperboard International in Toronto and Strathcona in Napanee) currently accept post-consumer boxboard, which must be clean and baled. Mills currently accepting post-consumer boxboard encourage municipal programs to limit collection to cereal and cracker boxes and pharmaceutical packages. At Strathcona Paper, post-consumer boxboard collected through Blue Box programs is used to manufacture detergent cartons. These cartons currently contain up to 28% post-consumer boxboard with the remaining 72% consisting of other recycled fibre material (*Recycling Canada*, July 1991).

According to PPEC, as of January 1994, recycled OBB demand by brandowners was 8,160 tonnes, while only 3,132 tonnes were available through Ontario municipal programs. This resulted in a shortfall of 5,028 tonnes which was required for recycling into boxboard (Mullinder, 1994).

An important source of higher quality post-consumer boxboard is the IC&I sector. IC&I-recovered boxboard also supplies the Strathcona Mill with secondary boxboard feedstock material. In 1992, the Strathcona facility substituted post-consumer boxboard (collected from the residential and IC&I sectors) for ONP at a rate of 21,000 tonnes. Of this, half (12,000 tonnes) was supplied by the Ontario IC&I market with the remaining imported from Quebec and the United States (Hunter, Strathcona).

Table H2.3 presents a summary of boxboard mills in the U.S., Ontario, Quebec and New Brunswick.

Table H2.3
Boxboard Mills in Eastern Canada

Mill	Location
Sonoco (formerly Paperboard Industries)	Trenton, Ontario
Sonoco	Brantford, Ontario
Fraser	Edmonton, NB
Cascades	East Angus, Quebec
Daishowa Forest Products Ltd.	Quebec City, Quebec
Strathcona Paper	Napanee, Ontario
Cascades Paperboard International	Toronto, Ontario

Market Prices
In 1992, market prices for post-consumer boxboard averaged $10 per tonne. More recently, the price has increased to $20 per tonne for boxboard collected through residential programs and $40 per tonne for boxboard collected from the IC&I sector (Hunter, Strathcona). The increase in price is attributed to improved quality of material and increased supply received by the mills.

Market Development and Future Market Trends for Boxboard
While several initiatives have been undertaken to identify new processes for recycling boxboard and new uses for recovered material, boxboard is not yet the focus of government market development initiatives. PPEC and OMMRI, along with brand owners, packagers and stakeholders have established a boxboard task group to identify new ways to capture boxboard, to use it in new packages and to find new markets for its use. (MOEE, October 1993).

The predominant current use of boxboard is for food packaging. Post-consumer boxboard can be recycled into new board sheet which is converted into boxes for cereals, frozen foods, crackers, etc. This application is limited due to requirements that food contact packaging not contain post consumer recycled content. Two solutions to this dilemma are being pursued. First, PPEC has been in negotiation with health officials to review the requirements for food packaging to contain only virgin materials. PPEC has asked federal health officials to comment on the viability of increasing post-consumer materials in packaging. Also, a U.S. company (Westvaco Corp.) has developed a bleached board containing post-consumer fibres suitable for food-contact packaging that meets with U.S. Food and Drug Administration standards (*TAPPI Journal*, March 1993).

Other potential markets include:

- ethanol production from boxboard is an alternative which has proven feasible at the research level. CanAgra is considering construction of a boxboard to ethanol plant to be located in the Bruce Peninsula. It would require 170,000 tonnes of boxboard annually. The decision to proceed with the project depends on a number of factors, such as exemption of taxes for alternative fuels, use of residuals generated in the process for co-generation, etc. Should the project proceed, it could become the largest single consumer of old boxboard in Ontario;

- a composting trial initiated by PPEC using boxboard as a feedstock met with disappointing results. High boron levels in finished compost persisted throughout the tests. These were attributed to the type of boxboard packaging (i.e. soap/detergent packaging) used as feedstock as well as the glues (with high boron content) used to construct the containers (*Recycling Canada*, April 1992);

- corporate initiatives exist to utilize recycled boxboard or to design for recycling. For example, Kraft Foods has switched from using a hot-melt glue to a water soluble glue in boxboard containers. Water soluble glues can be more easily and effectively removed during the cleaning process;

- some companies have taken the initiative to use more post-consumer boxboard. For example, Proctor & Gamble and Lever Brothers are now specifying a minimum of 25% post consumer boxboard as filler stock in their detergent containers and chipboard. These and other efforts in market development will increase the demand for boxboard with recycled content (Quinte, April 1993).

Other markets for boxboard are also being explored. These include animal bedding, building materials, roofing shingles, gypsum liner, construction paper, flower pots and insulation. If developed, some of these alternative boxboard end uses would be on a local or small scale.

Markets Outlook for GTA Collected Boxboard
The demand for post consumer boxboard traditionally has been relatively low in Ontario. If significant boxboard recovery efforts are initiated (e.g. if all GTA municipalities initiate expanded Blue Box programs), supply would probably exceed demand under current conditions.

H2.5 Markets for Old Magazines (OMG)

Introduction
OMG has found a niche in the paper market as a secondary feedstock material in the production of recycled content newsprint. Currently, most newsprint mills in Ontario accept OMG in the de-inking process. OMG offers benefits associated with a higher quality fibre and the clay content which increases the de-inking efficiency (*Waste Age*, Jan. 1991).

Definition
Old magazines (OMG) are now acknowledged as a separate grade of paper stock, having previously been considered part of the mixed paper grade. Magazines (Grade 10) consist of dry, baled coated magazines, catalogues, and similar printed materials and may contain a small percentage of uncoated news-type papers. Prohibited materials may not exceed 1 percent and total outthrows (not meeting the grade) may not exceed 3 percent. Common sources of OMG include overissue magazines and catalogues and residentially-generated magazines (ISRI, 1991).

Historical OMG Market Overview
Prior to 1990, post-consumer magazine collection was virtually non-existent. Any recycling of OMG consisted of collecting post-industrial cuttings from printing plants. The traditional production process for newsprint did not permit the direct incorporation of old magazines due to the ink and glue contaminants. With the significant increase in de-inking capacity in North American newsprint mills, demand for OMG has soared, (*Waste Age*, January 1991).

Current OMG Market Overview
Newsprint mills are the largest consumers of OMG, requiring OMG as a secondary feedstock in the production of recycled content newsprint. Technological developments in the de-inking process for old newsprint have resulted in the need for OMG as a feedstock due to it's strong fibres and clay content. Clay coatings are now considered valuable in de-inking mills to ensure prime efficiency by adding stiffness, bulk and opacity to the newsprint. The clay stock in the OMG is used in the flotation de-inking system to stabilize air bubbles generated as part of the cleaning process, which in turn facilitates separation of the ink from the ONP.

With the exception of Spruce Falls, ONP mills are reported to utilize old magazines at an average projected ratio of at least 7:3 (ONP:OMG) in newspaper production. It should be noted

however, that while a 30:70 ratio of OMG to ONP has generally been assumed for de-inked newsprint, some major mills have significantly downsized OMG requirements. *Resource Recycling* reports that one mill which had planned a 60:40 mix of ONP to OMG has found that between 5 and 10% OMG is a more satisfactory mix (*Resource Recycling* November, 1993). It reports that over the next nine months, mills will continue to experiment and more clarification of actual OMG needs and absorption capabilities will follow.

Table H2.4 summarizes newsprint mills in Ontario that are known to accept OMG.

Table H2.4
Ontario Newsprint Mills Using OMG

Mill	Location	Estimated 1993 OMG Consumption*
QUNO	Thorold	82,500
Atlantic Newsprint Company	Whitby	48,000
Abitibi Price	Iroquois Falls	12,900
Abitibi Price	Fort William	5,400
Canadian Pacific Forest Products	Thunder Bay	36,000
Total		**184,800**

* based on a 3:7 ratio of OMG to ONP in the production of newsprint.

Source: CPPA 1993, RCO, 1992.

Some mills accept OMG baled with ONP, which reduces the sorting and processing requirements for operators of residential recycling programs. However, those relying on spot markets will have to separate OMG to meet most market specifications and receive good prices. Because many mills have traditionally required OMG to be delivered separately from ONP, there has been some reluctance by program operators to expand existing residential recycling programs to include OMG.

The residential sector tends to provide a slow turnover of OMG and curbside recovery of OMG remains low, relative to demand. A recent U.S. study shows that approximately 10% of OMG generated is collected for recycling from residential sources, while a Canadian newsprint producer using OMG reported the ability to access only 3% of the required feedstock in the Northeast and in some major cities from curbside sources (*Resource Recycling* November, 1993). Magazine returns from stores and newsstands are an important additional source of OMG (Nelson, Atlantic).

Other major potential end uses of OMG include animal bedding, cellulose insulation, shingles, printing and writing paper, construction and wall board, recycled boxboard and tissue. Some of these end uses provide a limited demand on a local, small scale. OMG prices received from newsprint mills are likely to be higher which will likely deter the use of OMG for local, lower grade uses.

Market Prices

There is a limited history with respect to price trends for OMG. Prior to 1990, collection and sale of post-consumer magazines as a separate grade was virtually non existent. The current market price of OMG is $25-$30 per tonne (Bexton, Metro Waste Paper). The price for mixed ONP/OMG is also approximately $25-$30 per tonne (Quinte, 1993).

Prices between $10-$30 per tonne are still not sufficient to attract many programs to collect OMG. A price between $25-$30 per tonne is considered a threshold price; prices above $30 per tonne should attract many more collection programs (Apotheker, February 1993).

Future Market Trends For OMG
New developments have permitted some mills (such as Manistique, Michigan) to use 100% OMG in the production of newsprint.

Additions to recycled newsprint capacity in Ontario and Quebec are anticipated to increase overall demand for OMG by about 160,000 tonnes. The mills slated for future consumption of OMG are listed in Table H2.5. Demand for OMG within Ontario, coupled with that of Quebec (where local collection is very small) will significantly outstrip supply from within Ontario.

Table H2.5
Mills with Future OMG Capacity

Location	Proposed Start-up	OMG Requirements (tonnes)
Ontario		
Boise Cascades	(1995)	32,000 tonnes
Quebec		
Donahue	(1995)	27,000
Daishowa	(1993)	30,000
Kruger	(1993)	18,000
Domtar	(1995+)	unknown
Cascades	(1993)	31,000
Stone	(1995)	22,000
	Total OMG capacity	**160,000**
Source: (Sarazin, Daishowa) (CPPA, 1993) (RCO, 1992)		

Market Outlook For GTA Generated OMG
With the anticipated strong demand for ONP in Ontario and the beneficial characteristics associated with OMG as a secondary feedstock in the production of newsprint, markets for OMG are expected to remain strong. Pre-consumer sources of OMG (newsstand returns and printing plant cuttings and over runs) are of high quality. Annual demand from Ontario newsprint mills for an estimated 185,000 tonnes of OMG will provide markets for a significant level of post-consumer OMG collection within the GTA.

In summary, markets for OMG which could be collected and diverted in GTA are considered strong and are expected to remain viable for the foreseeable future.

H2.6 Markets for Fine Paper

Introduction
The primary markets for recovered fine paper include:

- fine paper;
- tissue;
- linerboard;
- corrugated containers;

- shingles and roofing paper, paperliner for drywall, boxboard, molded pulp, insulation and/or newsprint.

The manufacturing process for printing and writing paper and tissue products requires more sophisticated cleaning procedures than those required in the manufacturing of containerboard and boxboard. Introduction of legislation and policies requiring recycled content in printing papers coupled with increased fine paper recycling programs in offices has spurred Canadian mills that manufacture printing and writing papers to install de-inking facilities. Since 1985, the number of Canadian printing and writing paper manufacturing companies using recovered fine paper has increased from one to sixteen (CPPA, 1993).

Definition
The term fine paper is often used interchangeably with high grade office paper and printing-writing paper. The definition of fine paper includes computer print out (CPO), white ledger and copy paper, and other papers that are groundwood free. (Typical groundwood paper products include magazines, newsprint, catalogues, and telephone directories). According to the Institute of Scrap Recycling Industries, fine paper consists of several grades of paper such as Grade #40 - sorted white ledger, Grade #38 - sorted coloured ledger, and Grade #42 - computer print out. This definition specifically excludes a sub-category of high papers known as pulp substitutes which are pre-consumer specialty paper grades collected from industrial scrap sources (ISRI, 1991).

Historical Fine Paper Market Overview
The introduction of post-consumer fine paper in the manufacturing of printing and writing paper is a recent trend. Variations in the technology requirements have hindered the use of post-consumer fine paper in the past. Prior to the 1990s, most printing and writing paper was made from virgin fibres. Only recently have mills introduced de-inking procedures. Before that, the vast majority of mills in North America operated without de-inking facilities; therefore, secondary fibres had to meet stringent specifications, including minimal ink, and no contaminants. Mills preferred the pre-consumer fine paper furnish because it contained long fibres and no ink. According to the Canadian Pulp and Paper Association (CPPA), in 1985 only one Canadian mill used recovered paper as part of its fibre supply. In 1989, the number of Canadian mills using recovered paper had increased to two and it had reached sixteen by 1993. Eight mills located in Ontario accept fine paper/mixed paper. Other typical uses for recovered fine paper include manufacturing of tissue products and containerboard.

The collection and incorporation of post-consumer fine paper from offices and other IC&I generators is a relatively recent phenomenon. In the past, most secondary fibres used in the production of printing and writing papers and tissue products have consisted of pre-consumer fibres from offcuts, trimmings, and floor scraps generated by print shops and paper manufacturers. Some computer printout and white ledger paper from offices and other post-consumer generators were incorporated, but in relatively small portions. In 1987, the secondary fine paper furnish used by U.S. mills consisted of 74% pre-consumer fibre and 26% post-consumer fibre, according to the United States Office of Technology Assistance (1989).

Current Fine Paper Market Overview
The 1990s have become a turning point for use of, and demand for, fine paper by North American mills.

Paper mills have recently added de-inking facilities in order to meet the increased availability of post-consumer fine paper, coupled with the increased demand for recycled content paper products. The de-inking process removes inks, coatings, bindings, and other contaminants from the waste paper. The advent of the de-inking process has allowed paper mills to use a wider variety of fine paper grades including fine paper containing ink.

Table H2.6 provides a list of Ontario mills producing recycled content paper, using fine paper grades or mixed paper.

Table H2.6
Mills in Ontario Accepting Fine Paper Grades or Mixed Paper*

Mill	Location	Product
Atlantic Packaging	Whitby	Tissue
Beaverwood Fibre	Thorold	Special Fibreboard
Sonoco (Paperboard Industries)	Toronto	Container Board
QUNO	Thorold	Pilot project to incorporate into newsprint
Nasada	Thorold	Fine Paper
Noranda Forest	Thorold	Fine Paper
Strathcona	Napanee	Boxboard
Domtar	Mississauga	Containerboard
Domtar	St. Catharines	Fine Paper

Source: Wood, CPPA
*Note: List is not complete since not every CPPA member reports this information

The demand for recovered printing and writing papers has increased over the past several years. According to CPPA, domestic collection of recovered printing and writing paper from Canadian collection programs (mostly office paper programs) was estimated at 350,000 tonnes in 1991 and 380,000 tonnes in 1992 (CPPA, 1993).

Fine paper is in high demand for recycling because of the relatively high market price paid for ledger paper and computer printout paper compared with mixed paper and other groundwood papers (such as ONP, and OCC).

Many offices in Southern Ontario are currently engaged in office paper recycling programs. Additional sources will be realized once residential curbside programs are expanded to include fine paper collection. All fine paper collected through office paper recycling programs in Ontario is readily absorbed by the Ontario mills. According to one source, Ontario mills will have no problem incorporating additional supplies of fine paper into their productions (confidential source). Currently, Ontario mills import recovered fine paper from the United States, which is experiencing a temporary glut of fine paper.

Market Prices

In general, prices paid for fine paper vary dramatically depending on whether it is sold as mixed high grade (includes CPO, white ledger, and coloured ledger) or is sorted and sold as individual grades. For example, in late 1990, office mix traded at minus $10 per tonne in Toronto compared to $140 per tonne for CPO, and $110 to $145 per tonne for white and coloured ledger. In 1992, the price for CPO ranged from $190 to $220 per tonne and the price for white and coloured ledger ranged from $120 to $140 per tonne. On average, the fine paper grade collected between $100 to $120 per tonne (Hunter, Strathcona and Remouche, Domtar).

Prices for all sub grades of fine paper are expected to improve as capacity and demand increase over the next several years.

Diversion Trends
Although difficult to predict, efforts to reduce paper use through the use of electronic mail and other technical developments which may move us closer to the "paperless office", coupled with the reuse of paper, and double-sided printing and photocopying may result in a reduction in paper use and, correspondingly, the availability of post-consumer high grade paper from the IC&I sector.

The generation of fine paper by the residential sector may be affected as efforts to reduce the volume of junk mail increase. The trend among companies which distribute flyers and pamphlets is to switch from using fine paper to using newsprint. This activity may have some impact on the availability of post-consumer fine paper generated by the residential sector.

Market Development and Future Market Trends For Fine Paper
Several factors have already contributed to the increased use of post-consumer fine paper. These include

- the introduction of legislation and policies by government agencies and individual companies to use recycled content ledger paper (as seen of a federal level in the U.S.) (*Wastelines*, December 1993);
- increased demand by consumers for recycled content paper and tissue products; and
- the introduction of the Provincial 3Rs Regulations requiring source separation of office paper by 8 IC&I sectors.

It is also anticipated that a recent requirement by U.S. Executive Order on Federal Acquisition, Recycling and Waste Reduction, signed on October 20, 1993, will increase demand in the private sector (and at other levels of government) for recycled papers. This order mandates U.S. federal government agencies to buy recycled paper, requiring that all printing and writing paper purchased by the federal government contain 20 percent post-consumer content by the end of 1994. This will increase to 30 percent by the end of 1999 (*Wastelines*, December, 1993). While this specific initiative may not directly affect Canadian or Ontario manufacturing (Canadian paper is not usually sold to the U.S. government), since paper operates in a global market, it may result in a general increase in demand for recycled paper.

However, contamination of high grade papers in office paper recycling programs has traditionally proven to be a problem for paper collectors. Contaminants, such as self-adhesive labels, window envelopes, thermal (facsimile) paper, and sticky notes devalue the office mix if they are mixed with high grade fine paper. Several of these issues are being resolved. Office paper recycling programs that required a high level of paper separation activity by employees often led to poor product quality. The emerging trend among paper collectors is to establish mixed office paper recycling programs. The collected paper mix is then separated for its high grade papers at a processing facility.

The increased use of laser printers has also posed a problem for paper collectors and paper mills. Laser printed fine paper is difficult to de-ink sufficiently using the conventional flotation de-inking process. Despite the high quality ledger paper used in laser printing, this paper is most often used in products that do not require de-inking, such as paperboard, containerboard, and molded pulp products. Recent innovations in the de-inking technology are now enabling mills to use laser printed papers in their high grade feedstock. Other technical innovations are now permitting other post-consumer paper products (such as thermal (facsimile) paper, and window envelopes) to be included in recycling programs. Examples of this include:

- 3M has modified the glue used in their Post It notes to make them more recyclable. Their sticky notes are no longer considered a contaminant in recovered high grade paper (*Chemical Marketing Reporter*, Jan, 1992).

- Eastman Kodak is reportedly investigating the development of a mini mill at the site of its Rochester, New York research park office facility. Recovered paper from the 44,000 employee facility would be pulped, but not de-inked. Kodak is evaluating potential applications for the pulp.

- Inter City Papers of Toronto claims to be the first company in Canada to collect fine paper from its clients and then provide recycled content paper made from the recovered fine paper as part of a closed-loop recycling process (*Recycling Canada*, Feb, 1992).

In addition, demonstration projects have been conducted to determine the feasibility of interdicting post-consumer fine paper as feedstock in compost production and ethanol production (*Biocycle*, Dec, 1992).

Market Outlook For GTA Generated Fine Paper
Based on the above discussion, it is anticipated that markets will be available for fine paper recovered in GTA for the foreseeable future.

H2.7 Markets for Mixed Paper and Other Fibres

Introduction
Mixed waste paper grade is one of the more difficult grades to recycle due to the variability of paper grades within the mixture. Mixed grades vary in fibre length, contamination levels, and processing requirements. Consequently, this mix can be difficult to market when other more homogeneous substitutes, such as ONP and OCC, are readily available at a reasonable price.

There has been a recent change in the overall mixture of the mixed grade going to mills. Recycling companies and brokers increasingly tend to remove the more valuable, high grade paper, such as computer printout paper and white ledger paper, from the stream. The end use market for mixed paper, however, has remained fairly consistent over time. The major end users include mills manufacturing tissue products; boxboard; containerboard; and (to a lesser extent) roofing materials.

Definition
Mixed paper is a category that comprises all grades of waste paper including groundwood stock (ONP, OMG, OCC) and fine paper (CPO, white ledger and coloured ledger). Definitions of mixed paper vary according to the required use. The Institute of Scrap Recycling Industries, classifies mixed paper into two grades:

- Grade #1 – Mixed Paper - consists of a mixture of various qualities of paper not limited as to type of packing or fibre content. Prohibited materials may not exceed 2% and total outthrows may not exceed 10%;

- Grade #2 – Super Mixed Paper – consists of a baled, clean sorted mixture of various qualities of papers containing less than 10% of groundwood stock, coated or uncoated. Prohibited materials may not exceed 0.5% and total outthrows may not exceed 3%.

Based on these definitions, mixed paper can be understood, for the purposes of this document, to include a wide variety of papers (including ONP, OCC, boxboard, packaging materials, envelopes, and magazines) all in a mixed form. Mixed paper, by definition, is unsorted.

However, it is always possible that other higher grades of waste papers will be sorted from it and sold separately for considerably higher prices.

Historical Mixed Paper Market Overview

Mixed paper has typically been used by mills in processes that have higher tolerance for contamination and can accept heterogeneous feedstock mixes. Purchasers of mixed paper include mills manufacturing:

- boxboard;
- containerboard;
- molded pulp products;
- roofing products.

The use of mixed paper has been influenced by price and availability. Due to the nature of the manufacturing process, mills producing containerboard, boxboard, and roofing products can effectively substitute mixed paper for ONP and OCC as the prices fluctuate.

Consumption of mixed paper by Canadian mills has steadily increased from 50,000 tonnes in 1975 to 121,000 tonnes in 1988 (CPPA, 1991). However, the number of mills capable of using mixed paper is limited due to the problems associated with high levels of unknown mixed grades and contamination levels (Wood, CPPA).

Current Mixed Paper Market Overview

Unlike the fine paper market, end uses for mixed paper have not varied over the years. Boxboard industries are reported to have the potential to use as much as 40-50% mixed paper as furnish (Ruston, Jan. 1992). Corrugated medium manufacturers are also able to absorb minor fractions (10-20%) of residential mixed paper grades, provided contamination levels are not too high. Products such as asphalt-coated roofing felt and the paperboard lining of gypsum wall board have also provided a major outlet for mixed paper. In Ontario however, much of the mixed paper is consumed primarily by mills manufacturing tissue paper products, such as napkins, toilet paper, tissue paper, and containerboard.

Since 1988, the reported consumption of mixed paper by mills has declined. This is attributed partly to the low prices for ONP and OCC substitutes over the past several years, and partly to increased activity by paper collectors to separate out the higher grade ledger paper and computer print-out paper. Mills generally prefer ONP because it is less contaminated and easier to manage in the manufacturing process. Despite the decline, over the past two years consumption by Canadian mills of mixed paper has remained relatively stable, averaging between 104,000 tonnes and 109,000 tonnes for the years 1990 and 1991, respectively (CPPA, 1991).

In addition, demand for mixed paper, like other paper markets, is affected by consumer demand for recycled content paper and packaging products. Customer demand for tissue products containing recycled content has steadily increased over the past several years. This has affected the demand for mixed paper and its substitutes by those mills producing tissue products. The mixed paper market also has been affected by the strengthening of the organic roofing market.

Market Prices

The price paid for mixed paper is highly variable because the market for this commodity fluctuates with demand and the quality of the mixture required by individual mills. Prices have varied, ranging from $0 to 30 per tonne, with some mills paying virtually nothing for highly irregular mixed blends (Wood, CPPA and Dunkley, Quinte).

In general, low prices for mixed paper can be expected to continue as long as inexpensive ONP and OCC grades are available. As prices for ONP and OCC rise, demand and prices for mixed waste paper should rise as well. Prices may increase as a result of increased demand for mixed paper resulting from new technological innovations that permit greater use of mixed paper as a secondary feedstock.

Diversion Trends
As with office paper, it is difficult to predict the effect of efforts to reduce paper use such as: the use of electronic mail and other innovations, which may move society towards the paperless office; increased consumer resistance to junk mail; reuse of paper and packaging; supplier take-back programs for packaging; and double-sided printing and photocopying. Recycling will continue to increase marginally in the IC&I sector, with the major differences occurring in the type of materials permitted in the recycling stream. New technological innovations should result in the expansion of the types of mixed paper products permitted in the recycling stream (*Recycling Times*, Sept 1991).

Collection of mixed paper products will continue in the residential sector as well with continued expansion of the types of paper materials permitted in the recycling stream.

Market Development and Future Market Trends For Mixed Paper
Several demonstration projects have commenced recently which incorporate mixed paper in innovative production processes. Demonstration projects have been conducted to determine the feasibility of introducing post-consumer paper as feedstock in compost production and ethanol production. For example, two separate composting projects have begun in Durham, North Carolina and Ulster County, New York which use mixed residential paper as a compost feedstock (*Biocycle*, August, 1992 and December, 1992). Elsewhere, in Norval, Ontario and Gainsville, Florida, concurrent experiments are being conducted to test the production of fuel alcohol using low grade paper products (Norval experiment) and paper mill sludges (Gainsville experiment) (*Resource Recycling*, Aug 1992 and Dec 1992).

In addition, Can Fibre Group Ltd in Oakville, Ontario recently announced the development of an innovative technology that manufactures a wood-like product using wood and paper waste. The resulting fiberboard can be used in the production of furniture and windows (*Resource Recycling*, March 1993).

A new, emerging technology which may have a significant effect on the use and demand for lower grades of mixed paper is a steam explosion process patented by Recoupe Recycling of Montreal, Quebec. The technology uses steam to explode break the paper bonds of different grades of paper to produce a more homogenous fibre mixture (*Recycling Times*, May 1992).

Market Outlook for GTA Generated Mixed Paper
In the short-term, the demand will remain low for mixed paper used by paper mills as long as the mixed paper is unsorted and contains irregular grades. Composting and ethanol projects provide a potential end use market for these irregular mixes of paper. Mixed paper that is sorted into different grades of paper will continue to be used in the manufacturing of tissue products, boxboard and containerboard.

Markets for Telephone Directories (OTD)
Telephone directories are a sub-set of the mixed paper category, and are discussed separately because of several product-specific issues and initiatives. Significant gains have been made in the past few years in recycling of telephone directories. The fibre is high quality, but dyes, cover stock coatings and bindings presented problems for the mills. All GTA municipalities recover telephone directories, as do a number of IC&I establishments.

Cascades in Quebec recycled the majority of OTD from Ontario residential recycling programs in 1992 (Rowden, Cascades). Offshore markets, particularly in the Pacific Rim, also accept telephone directories. Cascades recycled 5,550 tonnes of OTD from Ontario; an additional 250 tonnes was exported in 1992.

Cascades recycles telephone directories into tissue products which contain a minimum of 33% content of yellow and white phonebooks. Examples of these products are the kitchen paper rolls currently sold by Loblaws and Canadian Tire as one of their line of "green" products (MOEE, 1993).

Telephone directories must be supplied to markets either strapped or in gaylords. They must be free of any other fibre contaminants. Some paper mills recycling OTD have developed systems to handle hot melt glue, while others prefer water soluble glues. Thus individual mills may have additional specific requirements. Ontario phonebooks (Bell Canada) are now printed with vegetable based inks, and the bindings are made with water soluble glues (Bell, 1992) in order to facilitate recycling.

Market Development and Future Market Trends for OTD
Bell Canada has initiated major research efforts to increase the recyclability of their directories as well as funding research into alternative uses for old directories. It is also continuing to increase the recycled content of its directory paper.

Bell has supported research into the use of directories for animal bedding and in the production of fiberboard. Both of these uses depend on the availability of markets. Shredded telephone directories have been successfully used as animal bedding at the New Liskeard College of Agriculture. Bell currently estimates directory recovery and recycling in the GTA at approximately 50%. Recovery levels could improve due to increased capacity at Cascades and other markets.

The major companies and/or organizations that produce telephone directories are active in supporting market development by implementing product stewardship initiatives and conducting research and development into new markets. For example, YPPEN members are hoping to recycle OTD back into directory paper and are committed to achieving 10% recycled content by 1993, 25% by 1995 and 40% by 1998 in their directories. This level of recycled content will stimulate demand for OTD from the North American mills. YPPEN is now collecting data to monitor recovery of OTD. They estimate that 17% of available phonebooks were collected as an average across North America, amounting to a total of 500,000 tons (*Resource Recycling*, November, 1993) (450,000 tonnes).

Glue and binding changes and the elimination of plastic coatings have also helped increase the recyclability of OTD, allowing access to a broader range of markets. These include end uses which recycle other fibres including boxboard, cellulose insulation, building materials and molded pulp products (Bell, 1992).

Telephone directory manufacturers have reduced paper usage through light weighting. Directories are also smaller to some extent due to the recession. Combined, these account for about a 15-20% reduction in total paper used for directories in Ontario over the past 2 years (Bell, 1992).

Research into the use of electronic directories is underway, but will require subscribers to have the necessary hardware and software. Most believe that they will not be introduced for about 5 years. Moreover, Bell is currently required by the CRTC to provide each subscriber with a directory.

The current market price of telephone directories is between $0-$5 per tonne and export markets pay $15 to $25 per tonne.

Markets for Polycoat Packaging

Polycoat packaging is a category that now includes gable top cartons, tetra bricks and polycoat packages. It is used primarily in milk containers and Tetra Pak drink boxes. Both Tetra Pak Inc. and International Paper Inc. which produce these packages have supported pilot collection and recycling programs in some jurisdictions outside of Ontario. Metro Toronto has committed to adding polycoat to their Blue Box program in 1994, and the Quinte program in Eastern Ontario has been collecting polycoat for over a year. Brampton and Mississauga are also involved in pilot programs that include polycoat for recycling. Polycoat is one of the materials which would be collected in Expanded Blue Box programs considered for the residential sector.

Due to plant size and feedstock requirements, it is considered unlikely that there ever will be a direct end-market for polycoat/located in the GTA (Harris, 1994). The polycoat collected in Quinte (milk containers and frozen food containers) is currently sold to Donco Paper in Ohio (Quinte, August, 1993). Four Ponderosa Fibres mills (California, Georgia and Tennessee) accept milk cartons (and drink boxes) for making market pulp used in writing paper, tissue, coated stock and copy paper at a higher price. Also, James River, Wisconsin and Pope & Talbot, Pennsylvania, accept polycoat for use in the production of tissue.

In general, most mills with a hydrapulper can accept polycoat. After hydrapulping, the pulp yield is 75% for milk cartons (40% for drink boxes) (*Wastelines*, February, 1991). The quality of the pulp is very high, and is similar to computer printouts, only the fibres are stronger and longer. Paper fibres are hydrapulped, and up to 10% can be incorporated in a pulp stream for paper manufacturing. Table H2.7 lists U.S. mills presently accepting post-consumer milk cartons.

Table H2.7
U.S. Mills Currently Accepting Polycoat

Mill	Location	End Use
Donco Paper	Ohio	mixed paper
Pope & Talbot	PA	tissue
James River	WI	tissue
Ponderosa	CA, GA, TN, WI	market pulp
Weyerhaeuser	WI	corrugated medium

International Paper Inc. is also in the process of constructing a mill in the New England Region.

Westvaco Mills presently converts a portion of old polycoat packaging into 125 ml drink boxes for McCain (Kabayama, 1994). However, the fibre from post-consumer milk cartons and drink boxes is often sold for the production of corrugated cardboard by Weyerhaeuser (located in Washington state, for Tetra Pak). The pulp is often used in the production of "merchant pulp". It may be used in a variety of end use applications and in some cases is used for a relatively low value product, (which does not utilize the post-consumer pulp to its full potential).

Quinte received approximately $90 (U.S.) per tonne of polycoat from Donco Paper in Ohio and Ponderosa Fiber currently pays $120 per air-dried ton. Also, seven mills accepting post-consumer milk cartons (mixed with drink boxes) in the U.S. guaranteed long-term prices (up

to the end of 1993) of $120 and $150 per ton, however it is reported that these prices have been artificially inflated in order to stimulate collection (*Resource Recycling*, August 1992).

GTA collected milk cartons are not likely to provide sufficient supply to justify a new hydrapluping mill (Harris, International Paper) located in the region . However, markets are readily available in the northeastern U.S. to process GTA-collected polycoat.

Market Outlook for Mixed Paper and Other Fibres

From the above discussion, it is concluded that markets will exist for most mixed papers as long as they are sorted into different paper grades. Prices will vary depending on the material.

H3.0 MARKETS FOR PLASTICS

H3.1 Introduction

Recycling of post-consumer plastics has not yet been fully developed for the range many resins, and combination of resins that are presently used and disposed. In general, markets for single resin plastic materials are stronger than for 'composites'. Markets for PET are better developed than they are for other materials (i.e., PP, PVC, PS).

End markets for recycled plastics require clean, stable sources of secondary feedstock. Plastics, unlike other recyclable materials, have an extremely low tolerance for contamination by other resin types and colours. Efforts have been and continue to be directed toward developing technologies capable of identifying, segregating and cleaning plastics.

Definition
Plastics are a petroleum-based product consisting of a great variety of resins with differing properties. Plastic resins are either thermoset or thermoplastic. Thermosetting plastics, such as fibreglass, cure or harden as a result of a chemical reaction, and cannot be remelted after being set. Thermoplastics can be remelted and shaped again. The packaging industry primarily uses thermoplastics because they can be easily formed into a multitude of shapes (B.C. Environment, 1990). Table H3.1 identifies typical plastic resins formed into thermoplastic packages.

Table H3.1
Plastic Resins Used In Packaging

Plastic Resin	Definition	Packaging Products
PET (Polyethylene Terapthalate)	P-100 -PET Mixed, bottles only P-101 -PET Clear, bottles only P-102- PET Green, bottles only P-103- PET Clear and Green P-104- PET Custom, bottles & jar P-105 - PET Mixed, containers	Soft drink bottles tubs trays peanut butter containers
HDPE (High Density Polyethylene)	P-200 - HDPE Mixed, bottles P-201- HDPE Natural, bottles P-202- Pigmented, bottles only	milk jugs water jugs liquid detergents
PVC (Polyvinyl Chloride)	P-300- PVC Mixed, bottles only P-301- PVC Natural, bottles P-302-PVC Pigmented, bottles	blister packs cooking oil bottles liquid detergent bottles
LDPE (Low Density Polyethylene)	P-400- LDPE Mixed, bottles only P-401-LDPE Mixed, bottles only P-402-LDPE Pigmented, bottles	lids squeeze bottles bread bags shopping bags
PP (Polypropylene)	P-500-PP Mixed, bottles only P-501-PP Natural, bottles only P-502-PP Pigmented, bottles	syrup bottles ketchup bottles yogurt containers margarine tubs
PS (Polystyrene)	P-600- PS Mixed, bottles only P-601- PS Natural, bottles only P-602- PS Pigmented, bottles	coffee cups meat trays packaging "peanuts"
Sources: ISRI, 1991 B.C. Environment, 1990		

H3.2 Plastics Market Overview

The advantages associated with plastics include light weight, durability, low cost, and ease of processing/converting. These advantages have led to a rapid increase in both the types of plastics resins available, and their use over the past couple of decades. According to the Society of Plastics Industry (SPI) domestic resin consumption in the U.S. rose 9.8% between 1991 and 1992 (Resource Recycling Plastics Recycling Update, January, 1993).

Over the years, the packaging industry has used different plastic resins for similar end-use applications. For example, tubs may be manufactured from a variety of resin types, including LDPE, HDPE and PP (Quinte, 1993). Detergent bottles may be manufactured from a variety of resins, including HDPE, PVC, PET and PP. Recycling companies most often have had to rely on hand sorting to separate the different resin types; however, poor or non-existent labelling make this difficult. Manual sorting relies on the ability of visually detect different resin properties which is one of its major limitations.

Greater emphasis has been placed recently on resin identification and developing technology to permit automatic identification and sorting of different resin types. The existing resin identification strategy was originally developed by the Society of the Plastics Industry, Inc. (SPI) which introduced a voluntary plastic coding system to help recyclers identify the types of plastic used in making individual bottles and containers. The system was introduced as a temporary solution to the sortation and identification problem facing recycling companies. The coding system has been successful to the extent that industry has adopted its use and voluntarily labelled its plastic products. As of February, 1994, 39 states in the U.S. have passed legislation mandating the coding of plastic bottles and containers using the SPI coding system (*Environmental Packaging*, February, 1994). Concerns with potential misunderstandings of the coding system are currently being addressed by the National Recycling Coalition and the Society of the Plastics Industry in the U.S. The SPI coding system is as follows:

- #1 - PETE (Polyethylene Terepthalate);
- #2 - HDPE (High Density Polyethylene);
- #3 - PVC (Polyvinyl Chloride);
- #4 - LDPE (Low Density Polyethylene);
- #5 - PP (Polypropylene);
- #6 - PS (Polystyrene);
- #7 - Other.

For most resins, the market situation for post-consumer plastics has not changed significantly over the past years. The percentage of post-consumer plastics recycled compared with plastic sales for the years 1990 and 1991 shows marginal increases, but represents nominal achievements overall, as shown in Table H3.2:

Table H3.2
Post Consumer Plastics Recycling

Resin		% Plastic Sales Recycled	
		1990	1991
PET	– soft drink bottles	29.8	35.1
HDPE	– natural bottles	5.9	14.0
	– base cups	37.7	41.1
	– other packaging	0.1	0.6
PVC	– bottles	0.7	0.8
LDPE/LLDPE	– other packaging	1.2	1.0
PS	– all packaging	0.6	1.2

Source: Modern Plastics, 1992

In order to provide closed loop recycling wherever possible, the prime goal of plastics recycling is to provide a secondary feedstock material that is virtually identical to virgin feedstock. This requires not only separation by resin type, but also by colour. Currently, most activities to sort plastics still rely on labour-intensive, manual processing. Contaminants such as other resins, and small mixtures of foil, dirt, and metal fragments significantly limit the value of post-consumer plastics (Minnesota Office of Waste Management, 1992).

The National Association of Plastic Container Recovery (NAPCOR) for example, is studying several sortation technologies, in order to reduce this barrier to recovery and market development (NAPCOR, Winter, 1994). However, the high capital costs coupled with the low prices for virgin resins have hindered the proliferation of a widespread plastic recycling industry. Consequently, end use market development has lagged behind the availability of post-consumer plastics.

The advantage associated with the light weight of plastic packaging has proven to be a disadvantage to recyclers trying to transport the material to end markets. Some recyclers have begun to granulate or densify the plastic material at the processing facility prior to shipment to the end-use market in order to achieve increased density and reduced transportation costs. The recyclers must maintain very high quality control standards over the granulated/densified secondary feedstock to ensure low contamination levels. Once the plastic material is granulated or densified it is very difficult to detect contamination levels, therefore, some brokers are reluctant to accept granulated or densified shipments since it reduces their ability to monitor the quality of the material (Minnesota Office of Waste Management, 1992). However, efforts are underway to improve plastics sortation technology for containers and granulated materials.

H3.3 Current Market Situation for Different Plastic Materials

The current market situation for different plastic resins varies depending on the type of resin and the level of market development that has taken place over the years. For this reason, each resin type is discussed separately.

PET
PET is a versatile and highly recyclable material, one that has long been included in residential curbside and drop-off recycling programs. PET is now mandated for collection in municipal recycling collection programs (by the Ontario 3Rs Regulations) and in multi-unit residential buildings. It is also mandated for recycling by hotels, motels and restaurants in the IC&I sector (MOEE, March, 1994).

Current North American markets for PET are very strong and are continuing to expand as new applications for the material are developed. Recycled PET can be used in a wide variety of applications that range from fibre for carpet (at the low value end) to bottle-grade resin (at the high value end). Utilization of virgin PET also continues to grow, particularly in applications where PET has displaced PVC (such as in some bottles, in blister packaging and other food packaging). While some forms of PET (e.g. A-PET and C-PET) are not collected for recycling, the majority of PET packaging (PETE - as in soft drink bottles) is technically recyclable and is collected in residential and an increasing number of IC&I programs.

Regulations 622/85 and 623/85 of the Ontario Environmental Protection Act require that a recycling rate of 50% be achieved for PET soft drink bottles. Twinpak, which markets a portion of the PET used in soft drink containers in Ontario, has subsidized the collection and recycling of PET in Ontario for many years. This subsidy is currently being reduced as market value for clear PET has proven to be strong and stable. (Potelle, Twinpak).

The PET that is collected through residential and IC&I recycling programs is sold loose or baled. PVC contamination can render a shipment unacceptable since PET and PVC are incompatible resins. PVC inclusion in the PET stream compromises the end product (primarily through discolouration) and there is a potential for release of chlorine in the processing. The maximum allowable PVC contamination in PET recycling is therefore 1% (Potelle, Twinpak).

One portion of Ontario generated PET is currently sold through Twinpak to Wellman, Inc. in Johnsonville, South Carolina (for processing). A sizable portion of Ontario PET is also sold to Plastrec of Bertherville, Quebec. Taken together, Wellman and Plastrec have capacity to process at least 48,100 tonnes per year of PET soft drink and some "custom" bottles (used for shampoos, peanut butter etc.) (Potelle, Twinpak). Twinpak pays 5-7.5¢ ($110 to $165 per tonne) for baled, sorted PET. The price paid by Twinpak has decreased from $400/tonne (approximately 18¢/lb.) within the last two years. The primary reason for the price drop is that more PET is now entering the market from non-soft drink uses such a liquor bottles, etc.

End uses for PET continue to grow. It is used increasingly as a feedstock for carpet fibre and is also utilized in fiberfill, industrial strapping, textile substitutes, geotextiles (e.g. landfill liners) and tennis ball containers.

Recycled PET can also be used in the manufacture of new food and soft drink containers. The depolymerization (methanolysis or glycolysis) processes used by Eastman, Shell, Hoechst-Celanese and others, now allow recycled post-consumer PET to be depolymerized and reblown into new bottles for use in some food applications. Concerns with depolymerization technology (i.e. gylycolysis, methanolysis) for PET include the high energy requirements, the need for clean scrap, the high cost (50% more expensive than virgin plastic), and the lack of applicability to other resins (Powell, May 1992). A new three layered bottle that includes a middle layer of recycled PET has also been developed by a Japanese company.

Other forms of PET that are generated primarily in IC&I sources include PET strapping and PET film (magnetic film, film packaging, blister packages etc.). Some of these (especially PET strapping and magnetic film) are finding viable and in some cases, lucrative markets. The infrastructure for collection of these materials is still underdeveloped. However, given the strong markets for these materials, increased volumes are likely to be recovered.

The only PET materials for which markets are not yet strong include PET-G, a material which is increasingly used in bottling. PET-G containers look similar to PVC, but are made of a different resin. Various other food packaging (eg. ovenable trays and delidomes) are made of additional PET resins which are not yet commonly recycled.

Processing capacity for bottle grade PET in the Northeastern U.S. has grown considerably over the last few years and competition for clean sources of feedstock is strong. For that reason, there is every expectation that any amount of PET that can be recovered in the GTA will be readily marketable for the foreseeable future.

HDPE

Like PET, HDPE is collected in several municipal recycling programs across Ontario and is recovered in over 1.6 million households in Ontario (OMMRI, 1994). HDPE is not specifically mandated for collection by residential programs in the Ontario 3Rs Regulations, although Rigid Containers and Plastic Film (which may contain HDPE) are included in the Supplementary List of Materials (MOEE, March 1994). Under the 3Rs Regulations, only IC&I generators in Manufacturing Establishments (whose employee hours in any one month exceed 16,000) are required to collected plastics including HDPE jugs, pails, crates and drums.

Residential programs typically accept only bottles from food, detergent and food oils. Non-food bottles (i.e. oil or pesticide bottles), film bags, and shipping containers are not accepted for recycling. Novacor is the primary producer of HDPE virgin resin, with Dow responsible for a small additional portion of resin produced in Canada.

HDPE collected through Ontario programs is purchased primarily by Dow or Dupont (the recycling segment of which was recently purchased by Novacor). Phillips Environmental has recently entered this market also as a material broker. The recovered HDPE is processed by Resource Plastics, Desbro Polymers, JMS Envirosave, Norseman Plastics and Plas Re-Tech (mixed plastics). Resource Plastics operates the largest processing facility with 7,000 tonnes per year capacity (Horn, 1994) for rigid plastics (with an additional 9,000 tonnes dedicated to film recycling). Desbro is approximately one half the size of Resource Plastics, accepting exclusively rigid containers. HDPE film is also processed by companies such as CAN AM Plastics Inc., Canadian Recycling Corporation Ltd. and Nu-Plast Inc. Processed rigid HDPE (which is either pelletized or flaked) is then sold back to Dow and Dupont for end-marketing.

DuPont pays between $50-130 tonne for HDPE collected in the GTA (Riddell, DuPont 1993). Resource Plastics (Brantford) pays $72.50/tonne for HDPE (Horn, Resource Plastics). End-markets include such manufacturers as Lever, Colgate, Esso and Shell. HDPE is often incorporated into new bottles with recycled layers or recycled content (e.g. bottles for oil, cleaning products). Other portions of HDPE are used for:

- construction and snow fence;
- trash cans;
- drums and pails;
- milk bottle cartons;
- grocery sacks;
- drainage pipes.

Although resin colouring does present a difficulty, rigid HDPE is generally viewed as a material that is highly recyclable from a technical standpoint, as long as it is clean and free of contamination. For DuPont however, recycling HDPE has not been extremely profitable as there has not been strong market demand for the recycled HDPE (Riddell, DuPont). A key reason for this can be seen in prices, where the price of virgin resin over the past few years has been practically equal to or lower than recycled, with a potentially more predictable and higher quality of material. Dow has also had problems marketing the recycled HDPE and has been involved in warehousing material pending firmer markets (Hyde, Dow). Dow markets HDPE primarily to Esso and Shell.

Despite these problems, the market for HDPE is reported to be growing. For instance, *Recycling Today* reported that Procter & Gamble had set more rigorous standards for post-consumer content bottles, with some plastic bottles containing at least 50% recycled content (Recycling Today, November, 1992). However, stability remains a problem for HDPE, with fluctuating resin prices, low cost wide spec resins and limited demand from end users.

The key issue in developing stable and strong end-markets for recovered HDPE lies in developing more cost-effective systems for sorting the material from commingled plastics. The resolution of this problem could result in firmer markets and greater diversion through HDPE recycling. Another important step to support plastics recycling (according to the recyclers) is to develop procurement guidelines that specify recycled content in plastic materials. Jim Horn of Resource Plastics suggests that a major portion of recovered plastics are sold to companies in the U.S. because demand in Canada is not strong enough to absorb the quantities that can be processed.

Plastic Film
Plastic film may consist of HDPE, LDPE or LLDPE which may be reprocessed into pellets, and depending on the mix, tailored for specific markets (*Modern Plastics*, Mid-December, 1992). Many large IC&I sector producers of pre and post-consumer film currently recycle their film through Resource Plastics. With an expanded film processing line, Resource Plastics now has the capacity to process 9,000 tonnes of plastic film per year (Horn, 1994). Reliable Recycling also accepts post-commercial film from 120 McDonald fast food restaurants in Ontario.

In the past, post-consumer plastic film from industrial sources has found more markets than curbside plastic film. The film is used in shopping bags, garbage bags and in some cases (where the blend is of lower quality), may be included in general products such as plastic lumber (*Modern Plastics*, Mid December, 1992). Contamination (i.e. inks, other plastics and non-plastics) is the major issue for film recycling and contamination levels determine whether this material can be recycled back into a new film or a lower grade use. A post-consumer content of 15% was successfully tested in the production of garbage bags, however, a reduction in non-plastic and other plastic impurities could double this percentage (Stanford, Climenhague and Bateman, May 1992). One company has also developed a product line that is composed of 50% curbside and 50% IC&I recycled LDPE film, which can be marketed at prices below virgin resin.

Until recently, collection of post-consumer plastic film from the residential sector has been limited in scope. In May 1993, the Plastics Film Manufacturers Association of Canada (PFMAC) strengthened its commitment to plastic recycling by agreeing to provide markets for post-consumer plastic film collected from the curbside recycling programs of five municipalities (Hamilton/Wentworth, Mississauga, Peterborough, Quinte and Brampton) (Climenhague, 1994). The post-consumer plastic film collected includes grocery sacks, shopping bags, milk pouches, bread bags, produce bag and overwraps for tissue products (*Recycling Canada*, April 1993; *Green Packaging 2000*, May 1993; Lauzon, May 1993). According to PFMAC, its major market is Polychem (Climenhague. February 1994). Polychem toll-processes the film into pellets for resale back to PFMAC's 12 member companies. Additional communities (such as Bluewater) collect and market materials independently. Everwood and Plas - Re - Tech have been named as additional markets.

Polystyrene (PS)
In Ontario, a total of 400,000 households are reported to have access to Blue Box collection of PS (LeClaire, 1994). In early 1993, two municipalities in Ontario (Quinte and Prince Edward County) were collecting and shipping post-consumer polystyrene generated by the residential sector to CPRA (OMMRI, 1993). Three GTA municipalities (Halton, Brampton, and Mississauga) are also now including PS in their programs.

In fall of 1991, the Canadian Polystyrene Recycling Association (CPRA) opened the first Canadian polystyrene recycling facility in Mississauga, Ontario. The CPRA facility has the capability to process both pre-consumer polystyrene generated by the IC&I sector as well as post-consumer polystyrene generated by the fast food industry and the residential sector (EPIC, May 1991).

At this time the IC&I sector provides the greatest source of polystyrene to the CPRA facility with an estimated 48% supplied by the food services sector, 17% by hospitals, and 12% by educational institutions (*Resource Recycling's Recycled Plastics Update*, December 1992). Post-consumer polystyrene is pre-sorted and sent to the facility, however, initially no revenues are generated from the sale of the post-consumer material. CPRA pays nearly 4¢ per pound ($88 per tonne), delivered (LeClaire, CPRA, 1994). Washing of the post-consumer material occurs in the facility.

Polystyrene processed by CPRA is primarily converted into durable plastics such as office products by Rubbermaid (e.g. in/out trays, scissors handles, etc. and wall sheathing) (*Resource Recycling's Recycled Plastic Update*, December 1992). Polystyrene is not typically converted back into food service packaging. However, a company in Sherman Oaks, California (Dolco Packaging) has recently received U.S. FDA non-objection status for using recycled PS in materials such as vegetable and fruit containers, clamshells and other food contact packaging (*Resource Recycling*. December, 1993). According to CPRA, record resin sales were achieved during 1993 and the early months of 1994 (LeClaire, 1994). Based on this recent history, it appears that markets would support collection of PS from additional programs in the GTA.

PVC

According to the U.S. Vinyl Institute, post-consumer uses for PVC are growing. PVC has suffered from concern about hazardous components of the plastic (e.g. chlorine) and PVC additives. However, the Vinyl Institute suggests that a major portion of the concerns are due to misconceptions and that others which have constituted problems (e.g. heavy metal-based heat stabilizers containing cadmium and lead) are being, or have been phased out (The Vinyl Institute, 1994). Regardless, several product brand-owners have been switching from packaging materials made of PVC to other materials for which recycling facilities are readily available and which do not cause public concern. PET has recently displaced PVC in several applications (e.g. in some blister packaging, bottles etc.).

The U.S. Vinyl Institute publishes a directory that lists over 60 U.S. recyclers for PVC. End uses listed include plastic lumber (for PVC commingled with other resins) as well as bottles and other packaging, floor tiles, notebook covers, traffic cones, construction products and other items. Several pilot programs are also being (or have been) completed to test and improve PVC recycling systems, focusing on recovery, sortation and developing end uses.

PVC is not currently collected from the residential sector in the GTA. It is sorted from mixed plastics in Quinte only, and is sent to a U.S. market. Initially, B.F. Goodrich purchased this material for approximately $150 U.S. per tonne (F.O.B. Quinte) (Kuracz, Oxy Chem). Now, Oxy Chem (Amsterdam, New York) accepts the material (F.O.B) for approximately $66 US per ton ($116/tonne) (Quinte, 1993).

Mixed Plastics

Markets for mixed plastics are not strong because there are relatively few opportunities for their use. Recyclers can typically find markets for PET and HDPE, and like to remove them from the plastic stream (because of their higher value). The "third bale" of material which remains contains plastics for which economic end markets have not been found to date. Superwood at one time manufactured plastic lumber from post-consumer mixed plastics. Financial problems coupled with the high cost of the plastic lumber forced the company's closure in 1991. The initiative was also impacted by process barriers which demanded high HDPE and LDPE (60%) content.

Although it does not presently accept GTA material, Plas-Re-Tech of Lindsay, Ontario charges $65/tonne to purchase plastic feedstocks, offering lumber back to suppliers at $45/tonne. This is approximately twice the price of conventional lumber. Plas Re-Tech accepts HDPE, LDPE, Polypropylene and Polystyrene and some PET from residential and IC&I sources (RCO, November 1992). PVC is not accepted. Plastic lumber advocates list benefits which include a durable damage resistant product, which is impenetrable by water and chemicals. However it is expensive and not visually appealing when compared with wood (Resource Recycling, July 1990) Conflicting views over the viability of end markets for 'plastic lumber' remain. Published plant capacity is 2.4 tonnes per year (O'Lane, Plas-Re-Tech).

Some GTA mixed plastics are also sent to Cascade Replas in Drummondville, Quebec. This facility was expected to process 4,400 tonnes in 1993 (Perrier, Cascade Replas). Cascade pays $40-60 tonne F.O.B. Quebec for post-consumer mixed plastics. The HDPE and PET must be left in bales. In other cases, mixed plastics are being shipped for free to China for use in the production of shoes and other products.

H3.4 Technical and Economic Challenges

Plastic recycling faces many technical challenges associated with sorting, washing, and contaminant removal, i.e., metal pieces, labels, adhesives, etc. One of the major challenges facing the plastic industry is to provide an effective automated sorting system that is affordable to most recyclers. Automated sorting is still in the early stage of development and remains an expensive proposition for most recyclers (White, 1992 and Minnesota Office of Waste Management, June 1992).

Conventional sorting systems generally permit two resin types to be successfully separated at a time but cannot economically or efficiently separate a variety of resin types at the same time. Most sorting and processing systems currently rely on manual, hand-sorting where workers selectively remove plastic containers as they move along a conveyor line. The process is labour intensive and considered an inefficient use of resources (Minnesota Office of Waste Management, June 1992).

Recyclers/reclaimers also use technologies that separate plastic resins based on their different densities. Float-sink tanks are used to separate HDPE and PET, which have significantly different densities. The process, however, cannot effectively separate PVC and PET, because they have virtually the same densities. Light media separation (alcohol and water) techniques and cyclone (dry and wet) techniques are also used to separate plastics. Both of these methods rely on the different densities of the plastics (Hock, AEL).

Plastics recycling is also influenced by economic conditions. Oil prices affect the price of virgin resin. Typically, an increase of $1 per barrel increases virgin plastic prices by 2.2 to 4.4 cents per kg (Edgecombe, EPIC). In 1992, a surplus of virgin material was available on the market due to new capacity brought on line. This coincided with an increased supply of post consumer resin. Recyclers/reclaimers had a difficult time competing with low-cost virgin materials; in some cases, the recyclers/reclaimers went out of business. At the present time, there is no clear incentive for intermediate processors to sort out the non-PET/HDPE resins when the materials have limited market value and represent only approximately 7% of all plastics (Proctor & Redfern Limited, 1990). It is anticipated, however, that virgin prices will rise over time and that this will likely help the plastic recycling industry compete with the virgin material producers (Nanda, Metro Toronto Works Department).

H3.5 Future Trends For Plastics

Stronger end-use markets must be developed through private and public sector initiatives, such as purchasing specifications and policies. An article in a document published by the New York State's Office of Recycling Market Development indicates that future plastic recycling will require the development of specialized, separation and processing centres that can operate at the necessary economy of scale to ensure secure supplies of resin types at lower costs. The article further states that if the plastic industry fails to develop cost competitive separation systems, the onus will be placed on government agencies to introduce regulatory measures such as resin bans, packaging regulations, and taxes (The Market, April 1993).

The Ontario Ministry of Economic Development and Trade is contributing $1.5 million to establish the Centre for Conservation of Plastic Resources which is expected to open by late summer, 1994 in Brantford, Ontario. Work at the centre will focus on innovation in market development for value-added plastic products to support plastics recycling.

Recent industry initiatives may also encourage greater activity by the plastics industry to develop the plastic recycling market. The CIPSI Packaging Stewardship Model will require significant changes in material management by brand owners. In essence, the model requires brand owners to assume greater responsibility for the generation and management of packaging wastes. Levies on packaging will be used to fund recycling programs and promote greater end-use market development for packaging materials including plastics (GPMC, 1992).

Reduce

In the past 10 years, there has been a general trend towards lightweighting of plastic packaging, through structural design or switching to other plastics. For example, PP is stronger than HDPE and by using the lighter, stronger plastic, where viable, a 30% reduction in weight can be achieved. Weight reduction is also possible for film. A laminate of two polymers can provide advantages such as reduced weight, improved barrier properties and superior strength/toughness.

An overall reduction in the generation of waste plastics is unlikely in the short-term. Existing plastic packagers continue to lightweight their plastic products. These new, lighter packages are expected to displace other packaging materials such as corrugated containers and glass. The industry expects a 6.3% increase per year in the plastic packaging market - representing about 40% of all Canadian consumption of resin (Proctor & Redfern Limited, 1990). As a result, the overall percentage of packaging materials which are plastics should increase as new plastic products enter the market.

Reuse

Refillable PET bottles are currently widely marketed in Europe and Central America as a soft drink package. However, they are not widely available in North America. This is primarily due to the concern that plastics may absorb some of the contents of the bottles and that this can lead to potential contamination problems. Technologies are presently being developed to detect and remove contaminants. Successful application of these technologies is expected to increase the use of refillable, reusable plastics, particularly PET (Powell, May 1992).

Companies such as Proctor and Gamble have introduced concentrated liquid detergents and fabric softeners in pouches to permit reuse of the original plastic containers. Other companies have introduced reusable pails and pallets which can be sent back to the supplier for refilling/reuse; for example Pepsi-Cola and Coca-Cola have begun to ship soft drinks in plastic, returnable crates. (Recycling Today, November 1992).

Recycle

One of the keys to successful recycling of plastics is to be able to economically identify, segregate, and clean the plastics. Automated sorting equipment is slowly becoming commercialized and over the past several years new developments in mechanical sorting have emerged:

- The "bottlesort" system relies on a computer controlled sensing device that is able to sort plastic bottles into three streams of plastic, including the separation of PET from PVC, the separation of PP from HDPE, and mixed colour separation. Once the sensory device has identified the plastic property, the position of the bottle is tracked as it moves along a conveyor line and forced air is used to eject the plastic container into the appropriate collection container (Woods, July 1993 and Modern Plastics 1992).

- The "vinylcycle" system separates PVC from other plastic bottles using an electromagnetic screening process. The presence of chlorine in the PVC triggers a computer-controlled air jet device that emits a stream of air at the PVC bottle to remove it from the other plastic containers (Powell, August 1992 and Modern Plastics 1992).

- A relatively new technique being developed "Polysort" is capable of sorting six categories of bottles, including polyproylene, PVC, natural HDPE, coloured HDPE, green PET and clear PET. The technology sorts by differentiating between colours and resins using two sensors. A microprocessor analyzes the information from the sensors and then sends a signal to the appropriate position along the conveyor for the plastic container to be shot into a storage bin (Powell, August 1992 and Woods, 1993).

Mixed depolymerization, whereby mixed plastics would be melted down to basic polymers, streamed into the various resin groupings and then used for a wide number of applications is not yet proven by the plastics industry. This process may be successful in North America in five or six years (Edgecombe, EPIC).

Post-consumer plastics are being tested as a feedstock for a variety of products. Post-consumer paper, (i.e. old newspaper), is being combined with plastic to produce a composite that is claimed to be stronger than virgin plastic. Potential uses include building and structural applications. Automobile manufacturers, such as BMW and GM, are using post-consumer plastics in car parts, such as interior and bumpers (Resource Recycling's Plastic Recycling Update, September 1992).

Market Outlook for GTA
Based on the previous discussion, while markets for some plastics like PET are strong and growing, markets for other plastics (especially mixed) are limited. If Expanded Blue Box or comprehensive three stream collection programs are considered or implemented by a number of GTA municipalities, a significant volume of plastics would enter the market, for which present technology and end market uses might be limited undercurrent circumstances.

PET and to a lesser extent, HDPE, are the most readily marketed materials. The remaining five plastic types, and any composite packaging materials are considered to have underdeveloped markets, and will continue to require implementation of strong market development policies.

H4.0 MARKETS FOR ORGANICS

H4.1 Introduction

Food and yard waste combined account for one-third of all residential and roughly 9-10% of the IC&I waste stream. Organic materials can be grouped in three primary classifications, according to the potential end uses of the material. These three categories are:

- food waste (including residential and IC&I food, as well as food production waste);
- yard waste (including brush, trimmings, leaves, grass etc.);
- compost.

In comparison to traditional recyclables, end uses and markets for organic waste are just emerging. Potential end uses are diverse and several potential end users are just beginning to learn of the availability and applicability of processed organic materials as replacement for traditional materials. Extensive telephone research of potential end users was conducted, however accurately defining the present or predicting the future market for reprocessed organic waste is difficult at this time.

To date, the majority of finished compost material, produced mainly by municipal leaf and yard waste sites has been used internally by municipal parks and public works departments and made available to local citizens at free giveaway days. While these end uses have proven to be adequate in handling the limited amounts of finished compost that have been produced to date, more secure long term markets will be required with any expansion of organic waste collection and processing.

For those paying markets that exist, specifications are strict. For markets where the end use is tied to food production (i.e. using compost as a soil amendment), consistency and quality of the finished material are essential.

The Ontario Ministry of the Environment and Energy (MOEE) has established a hierarchy for the management of residential and IC&I wet wastes. (Ontario Waste Reduction Office (WRO)). The MOEE hierarchy of organic waste diversion (in order of the highest value usage) is presented below:

1. Reduction
2. Primary Use
3. Recycling which includes home or on-site composting, use of food waste for animal feed and application of organic waste directly on the land
4. Offsite aerobic composting or anaerobic digestion, and animal feed and landspreading where waste is transported away for processing from the point of origin
5. Ethanol production, where animal feed is produced as a bi-product
6. Conversion of organic waste to liquid biofuels
7. Volume reduction, through either anaerobic or aerobic means
8. In-sink garburators for primarily food wastes
9. EFW
10. Landfill
11. Incineration
12. Export

End uses and paying markets for organic materials are sorted according to these categories. However some of these include categories which are considered beyond the scope of this report. Ethanol and liquid biofuel production are not considered of direct application to the organic wastes of interest to this study. These products generally are produced from specialty corps, rather than

from food or yard waste, although some preliminary research is being done in this area. In-sink garburators are not considered as an appropriate method of organic waste management for this study. EFW, landfill, incineration and export and outside of the scope of this study.

This schedule focusses on the potential diversion and/or end uses for residential and IC&I food and yard waste presented for the first four diversion categories above. The discussion is presented in three separate categories:

- food waste;
- yard waste; and
- compost.

H4.2 Markets and End Uses for Food Waste

Food waste consists of animal, vegetable, fruit scraps, surplus or spoilage, that is generated through the preparation and the consumption of food, by both the residential and IC&I sectors. Food waste management in general is guided by a hierarchy of end uses. These include:

- source reduction;
- human consumption of excess food;
- animal consumption;
- rendering;
- landspreading;
- on-site composting/anaerobic digestion;
- off-site composting/anaerobic digestion.

This hierarchy is based on the highest and best use of food waste to utilize the nutrients to the greatest extent possible.

Techniques used and achievements made in the GTA for food and yard waste management are presented below. The information presented is based on extensive telephone research, carried out in spring 1993. It is considered comprehensive but not exhaustive, as additional small scale and pilot projects are likely to be underway.

Source Reduction
The production of less waste is of first priority in the MOEE wet waste hierarchy. Through a program sponsored by the Ontario Green Workplace, efforts have been undertaken to reduce the amount of food waste generated at government institutions through the modification of menus and changes to the quantities of food prepared (Manager of Guelph Correctional Centre, 1992). This approach has been particularly successful in a number of correctional facilities.

Human Consumption of Excess Food - Gleaning
An expanding end use for surplus or off-spec food in good condition and from known reliable sources is food banks and social agencies. However, liability concerns on the part of the suppliers as well as the redistribution agencies continue to be an issue. While no formal provincial clearinghouse exists for this type of food waste, organizations such as Daily Bread and Second Harvest act as brokers for receiving and redistribution.

Toronto's Daily Bread Food Bank regularly receives truckload quantities of surplus non-perishable food, including breads and pasta, which is stockpiled for future use or redistributed in smaller quantities to other food banks within the GTA. Perishable food is also accepted, although it is not as easily dispersed to outlying social agencies, because of a lack of adequate refrigeration equipment at some of these facilities. (Nash, Orangeville Food Bank, 1993).

Second Harvest, a non-profit organization dealing specifically with perishable food, locates, collects and delivers perishable food to various social service agencies in the Metro Toronto area.

Major donations come from small green grocers, farmers markets and fast food establishments. In their 1991-1992 fiscal year, Second Harvest diverted about 450 tonnes of perishable food from landfill. Second Harvest is currently working with Transport Canada and health authorities to collect surplus milk and other packaged food from Air Canada and Cara Foods. Organizations similar to Second Harvest are in operation in Winnipeg, Calgary and Vancouver.

Animal Feed
Diversion of post industrial food waste to commercial manufacturers of animal feed has occurred for a number of years. Examples of industries which tend to carry out this practice include flour mills, and manufacturers of confections, bakery goods and cereals. Depending on the digestibility, available volumes and the nutrient levels of the waste product, the generators of the waste may receive revenue from the feed manufacturer, however, prices have fluctuated historically.

Some packaging industry culls and grocery store produce wastes generated primarily in the Golden Horseshoe area are currently being directly diverted for use as cattle and pig feed, although estimates of the amount diverted from the GTA are not available. Suppliers of this food waste typically do not receive any revenue for their material, and may even have to pay a nominal amount to cover transportation costs.

Agriculture Canada regulates the use of certain food wastes as animal feed, and requires that scraps be boiled before they are fed to swine or poultry. Swine feed must originate in the domestic IC&I sector, must not be rotten or moldy, and must be free of foreign materials (plastics, glass, knives, forks etc.) that might be injurious to the animal. Improper cooking of this waste can result in disease transmission between livestock and humans and among different types of livestock (such as salmonellosis) (Peer, 1992).

Hy Hopes Farms in Ajax, Ontario, runs a swill feeding operation licensed by the federal government. For a fee, the owner of this hog farm collects about 135 tons of organic material for 25 IC&I locations (including hospitals, restaurants, etc.) each week. Organic material is boiled and prepared according to government guidelines and is fed to the pigs (Bibb, Hy Hopes Farms, 1993).

Additional research is required to help build the necessary infrastructure, create stable markets, and to develop guidelines and standards (ie. nutrient value and contamination issues) regarding the suitability of certain foods for various livestock. However, expansion of this diversion alternative is also influenced by prices received by farmers for their livestock.

Rendering
Rendering is a long standing practice that involves cooking waste to remove moisture and separate fats and liquids from solids. The raw materials have until recently been primarily meat and meat by-products. Some rendering plants now accept restaurant food waste, production waste and other materials that may not be appropriate for any of the above uses.

The process produces a stable, inert product. All types of organics can be accepted for rendering, (including breads, tissue etc.) although dry, high protein fat is preferred for rendering. End uses include oils (for use in soap, cosmetics, animal feed etc.) or glycerine, which is used for a range of products (including soaps, wet naps, crayons, shoe polish etc.)

Approximately four renderers and an additional five "edible renderers" that render fats for the edible food business, operate in or near the GTA. Rothsay (formerly ORENCO) is the largest rendering company processing food waste from the GTA, with a plant located in Dundas. It processes approximately 40% of materials rendered in the area. If demand was adequate, ORENCO would be prepared to expand to three times its present capacity (Rusk, Rothsay).

Costs of energy, transportation and a shift in eating habits have contributed to a stagnant, if not reduced demand for traditional rendering. End markets for animal feeds produced through the rendering process are dwindling, although Canada remains a net importer of proteins for animal

feed. The costs of rendering are not competitive with cheaper forms of (lower quality) proteins such as soya meal. Renderers may pay from \$0.13-\$0.16/lb (\$286 to \$352/tonne) for "dry fat" but can charge from \$80 to \$140/tonne to process other, lower quality materials (Rusk, Rothsay).

Renderers will now consider all sources of food waste as possible feedstocks to their plants (which currently have excess capacity) because sources of their traditional feedstocks (meat and bones) are decreasing. Proteins rendered from food wastes can be used as a supplement in chicken feed, hog feed and beef feed. However, this is a low protein source, when compared with meat products and demand is not expected to increase dramatically within the near future.

Off-site Composting of Food Waste

Food waste can be source separated at the point of generation, and then taken off-site for composting in a centralized facility in either an open-windrow system or in an in-vessel system. Table H4.1 presents some food and yard waste processing facilities in the GTA. Municipal leaf and yard waste composting sites are not included in this table as they are discussed in Chapters 5 to 9 of the Service Technical Appendix, Volume 1. Markets for finished compost produced by these methods are discussed in a later section.

Table H4.1
Food and Yard Waste Processing Facilities in GTA[1]

Facility	Location	Capacity (tonnes/ yr) [2]	Process	Materials Accepted	Comments
Scott's Farms	Halton	• 25,000	• windrow composting	• leaf and yard waste, some wood waste and limited paper • primarily IC&I with some municipal/ residential	• awaiting appeal (August '93) of C of A to re-establish food waste composting • presently operating at one third capacity
Altreat	Orangeville	• 50,000	• composting	• yard waste manure filter cake	• strictly IC&I waste • operating at less than 1/2 capacity
George Sant & Sons	York (Kleinburg)	• 80	• open windrow compost	• leaves	• wants to receive leaves from GTA municipalities
Hy Hopes Farms	Durham (Ajax)	• 1,470	• swill feed	• food waste • hospitals, restaurants etc.	• operating over 60 years
Barret Farms	Durham (Brooklin)	• 1,980	• swill feed	• Metro IC&I	
Rothsay	•Dundas	• 104,000	• rendering		• prepared to expand if demand and material is available
Daily Bread Food Bank	Toronto	• not stated • can increase	• human consumption	• dry food	• voluntary
Second Harvest	Metro	• 450	• human consumption	• IC&I	• accepted 450 tonnes in 1992 • could expand if funds available

Table H4.1
Food and Yard Waste Processing Facilities in GTA (cont'd)

PROPOSED IC&I COMPOSTING FACILITIES					
Facility	**Location**	**Capacity (tonnes/ yr) 2**	**Process**	**Materials Accepted**	**Comments**
SWEDA Farms	Durham (Blackstock)	• 72,000	• compost	• chicken manure (on-site, proposed leaves, grass, paper sludge etc.	• proposed expansion; presently operate indoor, in-vessel process for organic fertilizer
Metro Toronto	Metro	• 12,500	• in-vessel compost		• existing facility at Dufferin Transfer Station • proposed Fairfield Digester use
Mammone Disposal System Ltd..	York (Maple)	• 15,000	• windrow composting	• OCC/wood waste/ yard waste, manure • from grocery and other IC&I sources	• operating in-vessel process since 1967 • proposed upgrade -- awaiting confirmation for expanded C of A
PROPOSED MUNICIPAL COMPOSTING SITES					
Peel		• 69,000			• may be shared with Halton
Halton		• capacity not available			• may be shared with Peel

1. Municipal leaf and yard waste composting sites are described in chapters 5 to 9 of Service Appendix Volume 1.

2. Based on 250 day/year operations

Sources: Personal communications with industry contacts and municipal officials referenced at conclusion of chapter.

Landspreading of Food Wastes

Application of some types of clean post-industrial food, yard and other organic waste is in the developing stages. Examples of these types of waste include:

- grape pressings and winery lees;
- wood pulp and paper processing wastes;
- food and canning industries' processing wastes;
- culled vegetables;
- leaves.

The major disadvantage of this method over other diversion alternatives, particularly centralized composting, is the inability to apply wastes to the land continually throughout the year. The Ministry of Environment and Energy recently released new guidelines for the land application of organic materials other than sewage sludge. Some changes in the new guidelines include lower limits for heavy metals, and restrictions regarding the proximity of landspreading facilities to other land uses.

There are currently 12 farms licensed for land application in Ontario. Leaves collected in some municipalities in Halton Region, as well as chipped Christmas trees from the City of Brampton are being applied directly to agricultural land. These municipalities do not receive revenues for this

material. Instead, diversion through landspreading is viewed as a means of saving the costs associated with centralized composting activities.

Home and IC&I On-Site Composting
Home (backyard) and on-site composting provide a viable approach to management of organic wastes. Backyard composting is described fully in Schedule B of the Service Technical Appendix, Volume 2.

Although not as prevalent as home composting, on-site management of food waste by IC&I generators, in particular institutions, is expanding. A number of manufacturers of home composting units have developed commercial sized units, more suitable for handling larger amounts of food wastes. Constraints to the expansion of this diversion alternative include lack of available space, purchase price of the units, and the level of ongoing maintenance that is required.

Through the Ontario Green Workplace program, on-site demonstration projects were developed in 1992 at eight government facilities. One of these facilities was the Mimico Correctional Centre. Mimico is testing one prototype in-vessel composting unit (the Ecolyzer) which is designed to accept up to 100 pounds of food waste per day, and to require as little as 15 minutes per day for ongoing maintenance. An in-vessel unit has also been installed at the Ontario Science Centre that will be capable of composting all of the food waste generated at the Centre as well as wastes from Queen's Park and the Legislative Building.

H4.3 Markets and End Uses for Yard Waste

Yard wastes refer to grass clippings, brush, leaves, trimmings and other organic landscaping wastes. It excludes tree trunks and cut lumber.

The hierarchy for management of leaf and yard wastes is as follows:

- source reduction;
- direct use of landspreading or chipping;
- composting.

Reduction
Source reduction opportunities exist to encourage residents to reduce the amount of yard waste they generate. Public education plays a key role in all of these alternatives.

Grasscycling, a waste reduction technique initially developed in Texas, involves leaving grass clippings on the lawn. Residents are educated on proper mowing, fertilizing and watering practices, through door-to-door distribution of information materials, radio and television ads, newspaper articles etc. In 1990, using the Texas program as a model, Montgomery County, Maryland was able to keep about 62% (25,000 tons) of all residential grass clippings out of the landfill.

The City of Waterloo has been promoting grasscycling since May 1991. In 1992, the City conducted a research project to identify the most effective ways to divert yard waste from landfill. The research showed that implementing an aggressive grasscycling promotion and education program was the most cost-effective way to divert grass clippings from landfill. Using volunteers to distribute educational material, the total cost of this form of reduction was estimated to be about $1 per household. The City estimated that through implementation of a grasscycling program, and a landfill ban on grass clippings, between $25,000 to $80,000 would be saved annually on tipping fees, garbage collection costs would be reduced, and between 500 and 975 tonnes of grass would be diverted each year from landfill (based on 475 kg of grass clippings per household per year) (City of Waterloo, March 1992). As a comparison, costs for providing separate collection for

grass clippings and for composting at a centralized facility were estimated to be approximately $140/tonne in the Region.

One method to reduce the quantity of leaf and yard waste generation is to promote xeriscaping, which is lawn and garden design to minimize water and fertilizer use, utilizing plant species which generate very low waste quantities, sometimes due to slow growth rates. This is more applicable for new developments, and may suit the lifestyles of residents not interested in high maintenance lawns and gardens.

Home and On-site Composting
Home composting activity can divert significant quantities of leaf and yard waste. In some neighbourhoods, particularly those with mature trees and landscaping, one or two backyard composters may not provide adequate capacity for the leaf and yard waste generated. Depending on the size of the unit, on-site composting operations may be capable of handling all the leaf and yard waste generated by an IC&I establishment. Home and on-site composting requires the addition of carbonaceous material like leaves and small twigs to balance the high nitrogen levels typically found in residential food waste.

Source Separated Leaves and Brush
A few municipalities in the GTA arrange for nearby farmers to accept their fall leaves, for plowing into fallow fields. In addition, leaves are delivered by some municipalities to Scotts Farms, a private composting facility, where they are stored and used as a bulking agent for incoming loads of food wastes.

Chipped brush and tree limbs are frequently used by centralized food waste composting facilities as an amendment material. While most centralized compost facilities charge a tipping fee for loads of organic waste entering their site, often the tipping fee for clean loads of wood chips is reduced to encourage deliveries.

Centralized Composting
Most source separated leaf and yard wastes which are picked up in separate curbside collections are composted at open windrow facilities located in each GTA Region. Operation of these facilities is discussed in Chapters 5 to 9 of the Service Technical Appendix.

H4.4 Markets for Compost

Developing end uses for compost is a gradual long term task, that requires educating potential end users of the properties and qualities of the product and correspondingly, developing a product that suits the needs of potential end users (WRAC). The key to marketing organics is to produce a very high quality finished material; any below-standard material will be difficult to market, especially as availability increases (Taylor, June 1993).

Compost produced in Ontario must be tested against the Ministry of Environment and Energy Interim Guidelines for the Production and Use of Aerobic Compost. (Ontario Ministry of the Environment, November 1991). These guidelines, which were adapted from the Ministry's standards for measuring metals in non-contaminated rural soils, are generally perceived to be one of the most stringent in the world. The guidelines create two grades of finished compost. The highest grade, referred to a "compost product," allows for unrestricted distribution of finished material. This grade would include compost that was suitable for sale (although it may be further regulated by the Federal Fertilizers Act), or to be given away to homeowners. A second grade, "controlled compost", places restrictions on the sites where compost can be applied. Any material that exceeds the guidelines for controlled compost must be handled as a waste product.

Other parameters that end markets use to measure the quality of finished compost include:

- soluble salts and sodium content;
- stability;
- C:N ratio;
- available nutrient content;
- particle size.

High grade compost can command about $8/cubic yard or $5/tonne(Taylor, June 1992). Based on experiences of the Mississauga Composting Pilot Project, prices for finished compost will vary according to time of year, transportation costs and quality of the finished product. To date they have ranged from $4 to $15/cubic yard (Rivers, 1993). With the expansion of composting activities, it is anticipated that current prices will drop. However, experts predict that there will never be a time when generators will have to pay to get rid of high quality product (Taylor, June 1993).

Depending on whether chipped brush or other woody organics are mixed in the feedstock, compost product can be used as a mulch or as a substitute for peat moss, or other soil amending materials. To date, mulches have been more difficult to market than high quality leaf compost (Taylor, June 1993). An attempt was made during this study (Spring 1993) to contact landscaping and horticultural associations and other sources to identify quantities of composted material that are presently being utilized. The contacts were also asked to estimate future potential demand for finished compost. In many cases, this information was not possible to obtain. Some of the more common current and potential uses for GTA are described below.

Municipal Public Works and Parks and Recreation Departments
Several of the municipal parks departments in the GTA have, for a number of years, been using finished leaf compost , sometimes blended with topsoil, as top dressing for their lawns and flower beds. Information obtained through telephone conversations with some Parks Departments located within the GTA, indicated that demand exceeds current supply although specific figures were not available. Public Works Departments use finished compost as a substitute for topsoil, to repair excavations.

For the above end uses, the compost manufacturer (in most cases, the municipality itself), receives no revenue for the finished product, however, compost may displace purchases of screened topsoil. Because records of where compost is actually used could be easily maintained, this type of end use may prove to be suitable for application of controlled compost.

Private Landscapers and Developers
Historically, landscapers and developers in the GTA have represented the largest purchasers of available high quality compost, for top dressing, mulch, and use as a soil amendment. This market is expected to improve, as the availability of topsoil decreases.

Greenhouse and Potting Mixtures
High quality compost can make up to 40% of the growing medium for plants. Of special concern however are the consistency of nutrient levels and soluble salt concentrations. (Bates, University of Guelph, 1991). AllTreat, a private composting operation located in Arthur, Ontario, currently produces specialized blends, some of which are designed to replace peat and composted manures. Various mixes are now being marketed to the public through grocery stores and garden centres. (Dempster, March 1993).

Field Crops, Commercial Fruits and Vegetables
To date, in only a few instances, finished compost has been applied to producing agricultural land. However, it is by far the largest potential outlet for high quality product. While this potential outlet

is not likely to pay high prices, it is capable of utilizing very large quantities if it is delivered and spread at no charge (Bates, 1991).

If compost is used to top dress fields, a pH of 5.7 is required. Field crops are selected according to existing soil conditions, so it is essential that any top dressing of compost does not alter these conditions.

Landfill Cover

According to an American study team (Buhr et al, January, 1993), landfill cover and surface mine reclamation provide an immediate use for municipal compost that can, in theory, be applied while other markets are being developed. These offer a potential stable market for low grade and non-uniform compost products.

As presently planned, the proposed landfill sites in the three GTA service areas would not require compost, either as daily cover or for landfill capping (Alton, Fedec, Theodorolus, March, 1993). Thus, while landfill cover does provide a good potential end use for composted material, as presently planned, the IWA landfill sites do not anticipate any significant requirement for this material.

Market Outlook for Organics

The above section has described several possible end uses for organics (food and yard wastes) generated in the GTA. Some of these depend on composting of the organics, and the end uses available will depend on the quality of the finished compost. There appears to be adequate capacity to absorb high quality compost at prices varying from zero to $10/tonne.

Lower quality compost has more limited applications such as landfill cover, or rehabilitation of areas not intended for residential development. Again there is likely to be adequate capacity to absorb this material at zero revenue. The costs of transportation may have to be absorbed by the compost generator. The higher uses of organics should be explored prior to directing food or yard waste to centralized composting or anaerobic digestion. These include re-distribution of food waste, or landspreading of food wastes and leaves, where viable.

H5.0 MARKETS FOR METALS

H5.1 Steel

Definition
Tinplate steel is a ferrous metal commonly found in the residential and IC&I waste stream. This includes food and beverage cans, aerosol containers and paint cans. Post-industrial and post-use forms of ferrous metal include heavy industrial scrap metal (steel supports and reinforcement bars), automobiles and durable household appliances. Reprocessed steel may be utilized in, but is not restricted to closed loop recycling.

Current Steel Markets Overview
The demand and end market capacity for recycled tinplate steel is well-established in the GTA CSCRC (Canadian Steel Can Recycling Council) acts as an umbrella organization for Ontario steelmakers. Demand for tinplate steel, by (CSCRC) members and Metals Recovery Inc. (MRI) (a major processor that receives tinplate steel, separates the materials and markets the tin and steel) outpaces supply.

MRI/Philip Environmental is a major end market for secondary tinplate steel located near the GTA (in Hamilton, Ontario). Although MRI is not a steel manufacturer, the company de-tins steel, and markets both the recovered steel and tin. MRI and CSCRC both state that the market will be able to absorb any new supplies of cans which might become available from IC&I programs, and increased consumer participation in residential recycling programs.

Recycled steel food and beverage cans are melted with other scrap metals and used for a variety of applications, such as in the production of flat-rolled steel and reinforcing bars. Tinplate steel may be marketed to either of steel mills, detinning operations or iron and steel foundries. In these processes, cans may be either mixed with other scrap to form a scrap charge (which is mixed with virgin ore in blast or arc furnaces to form new steel products), de-tinned for tin-ingots and steel or simply flattened and baled prior to sale.

De-tinning operations extract tinplate coating from the steel. The coating is sold to the tin industry and detinned steel is sold to the steel industry. Iron and steel foundries generally use 30% to 40% scrap steel mix in the fabrication of cast and molded parts for industrial uses. An estimated 10% will derive from post-consumer sources (Moore Dofasco, 1993).

The Canadian Steel Can Recycling Council acts as an umbrella organization for Ontario steelmakers. Key markets include Stelco and Dofasco in Ontario. Another portion of Ontario steel is currently exported to mills in the U.S., due to the prices paid.

The market for tinplate steel has been stable, with ample market capacity provided by the steel mills. Steel production is affected by the overall level of economic activity especially in the automotive, construction and transportation sectors. The amount of steel available for recovery through recycling programs is likely to change after the spring of 1994, when Pepsi Cola Can Ltd, Coca Cola Ltd. and Cott Beverage will begin packaging soft drinks in aluminum, causing a reduction in the volume of steel cans available for recycling.

Tinplate Steel Prices
CSCRC reports prices of approximately \$75/tonne for loose or baled cans, and approximately \$95/tonne for cans that are densified to end market specifications (Paulowich, CSCRC). Prices are guaranteed by Stelco and Dofasco. (MRI did not wish to discuss prices paid for metal cans).

Market prices were not available at the time of writing for other forms of steel scrap. However, sources report that no significant changes in pricing are foreseen at this time.

Diversion Trends
Recycling of tinplate steel continues to rise in North America as greater numbers of consumers gain access to depot and curbside recycling programs. For example, in Ontario the steel can recycling rate is estimated at 70%.

Source reduction has been accomplished through lightweighting efforts on the part of steel can manufacturers. Steel cans have been reduced in weight by 30% in the last few years. Further reductions are not anticipated. The Canadian Steel Can Recycling Council has estimated a current post-consumer steel content of tinplate steel cans at 10%, with an anticipated upper limit of 25-35%.

CSCRC is developing a test project currently with the Canadian Aerosol Bureau and with one Ontario community to recycle aerosol and paint cans in the Blue Box program. The council is presently developing a workplan for collection, anticipating results by late spring, 1994. The intent of this research is to develop full-scale recycling for other small to medium sized Ontario communities (Paulowich, CSCRC, February 1994).

The CSCRC reported the following approximate tonnages received for recycling:

Year	Steel Cans Received (tonnes)
1986	2,900
1987	4,400
1988	9,900
1989	16,300
1990	25,800
1991	47,200 (CSCRC estimated an additional 7,300 tonnes of cans were exported, and Algoma Steel received approximately 600 tonnes)
1992	67,100
1993 estimate	81,600 (projected target)

MRI did not provide recycled tonnages available, due to confidentiality concerns.

Future Market Trends for Steel
Demand for steel for re-manufacturing new steel products is expected to remain strong. Opportunities for local market development using secondary tinplate are limited. No new uses for recycled ferrous metal are foreseen at this time.

Market Outlook for GTA Generated Tinplate Steel
It is anticipated that sufficient capacity exists within local mills to absorb any increases in GTA recovery of secondary steel.

H5.2 Markets for Aluminum

Introduction
Aluminum in the waste stream consists of both consumer and industrial products. The intrinsic high value of aluminum has always created a demand for the metal. The recycling infrastructure for each type of aluminum product is different. For that reason this summary of aluminum discusses recycling of consumer products and industrial aluminum products separately.

Definition
Recycling of scrap aluminum (i.e. industrial aluminum) is a well-established practice. A large portion of secondary aluminum is generated directly through the IC&I sector. Post-use industrial products such as aluminum building products, automotive parts, trailers, aeronautical parts, roadsigns and supports have also been reprocessed. Consumer products that consist primarily of beverage cans with some aerosol cans and rigid and flexible products such as pie plates and foil wrap also provide feedstocks for aluminum recycling. Additional sources of aluminum is also generated in the residential sector include aluminum siding, lawn chairs and barbecues.

Current Market Overview for Aluminum Used Beverage Containers
The generation of aluminum beverage cans in Ontario from soft drink, domestic and imported beer is estimated at 13,700 tonnes. A smaller, but unknown quantity of juices, imported beverages and aluminum food cans are also generated (Confidential Client). The primary market for aluminum beverage cans is Alcan Recycling in Brampton. In 1991, Alcan handled 91% of the recycled aluminum cans collected in Ontario. Aluminum cans are processed into bales which are transported to one of Alcan's re-processing facilities in Oswego, New York or Berea, Kentucky for melting into aluminum ingots from which aluminum can sheet is produced. The rolled can sheet is used for producing new beverage cans.

Material Recovery Industries (MRI) in Hamilton accepts mixed loads of steel and aluminum cans. MRI (owned by Philips Environmental) separates the steel from the aluminum and ships the materials to market. MRI sells the recovered aluminum to Alcan and other United States markets. Quantities handled and prices paid were not available from MRI.

Aluminum cans are collected in all GTA curbside recycling programs. Most aluminum cans recovered in the GTA are exported to the United States for reprocessing into can sheet. The primary American markets include Reynolds Aluminum, Golden Recycling, Anheuser-Busch and Connecticut Metals (Confidential Client). The volume of aluminum cans collected is expected to increase as the transition from steel to aluminum soft drink cans is made by the major soft drink companies in the province (Malone, Alcan, 1994). The increase is likely to be seen by late 1994.

Within the GTA, aluminum foil is only collected through the curbside collection in Mississauga. The generation of aluminum foil products in Ontario is estimated at 4,700 tonnes. An estimated 7.5 million units or 300 tonnes of aluminum aerosol products are also consumed in Ontario (Confidential industry representative, 1993). Aluminum foil specifications require that foil and rigid containers consist of clean, old, pure, uncoated, unalloyed aluminum. The aluminum foil and rigid containers should be free of leftover food and anodized foil, radar foil, paper, plastics or any other foreign materials.

Metro municipalities are planning to add foil to programs within the next year. Alcan and Metro Toronto are sponsoring an aluminum foil recovery program through "Meals on Wheels". Foil that is collected in the GTA is currently sent to the Alcan plant in Guelph.

Specifications for scrap aluminum vary from market to market and depend on the type of aluminum alloy purchased. For example, used beverage container material must be magnetically separated and free of steel cans, tramp iron, lead, bottle caps, plastics, oxidization, sand, paper, glass, wood, dirt, grease, trash and other foreign substances. Baling and densification of aluminum cans is acceptable. Bale densities are between 14 to 22 lbs. per cubic foot with a minimum bale size of 30 cubic feet. Densified aluminum can biscuits should have a density between 30 to 45 lbs. per cubic foot and be of a uniform size (Alcan Recycling, April 1991).

Aluminum products such as aerosol cans and tubes have not been collected through curbside or IC&I recycling programs due to concern about volatile products and potential a dangers to collection workers. However, they are included in several hazardous waste drop-off programs in the GTA.

Current Aluminum Market Overview for Non-UBC Material
Aluminum is utilized extensively in the automotive industry (bumpers, transmissions, radiators, pistons etc.), electrical industry, transportation sector (tractor trailers, truck and bus paneling etc.), building products (siding, doors, windows, eavestrove etc.), aircraft industry (aircraft fuselage and parts), recreational uses (lawn chairs, barbecues, slides etc.) and the majority of roadsigns and supports.

Most of the applications are durable goods that do not become waste for years to come. A wide range of aluminum applications are small components of larger manufactured items. For example, the average car has 66 kilograms of aluminum (Fuller, Wabash Alloy Ontario 1993).

The majority of scrap aluminum is generated in the IC&I sector, either as post industrial trim or, to a lesser extent, as post-use products. Only a small portion of aluminum scrap (approximately 2%) is generated in the residential sector (Lobel, House of Metals). Post industrial aluminum is generally sold to a dealer who may sort and bale the material for transport to the end market. The majority of post-consumer scrap is also sold through scrap dealers to brokers (in many cases by-passing developing municipal recovery programs). End markets smelt the material according to grade, and reprocess it as an alloy or as aluminum sheeting.

There are three primary markets for scrap aluminum collected in the GTA which include Wabush Alloys Ontario in Toronto, Federator Genco in Hamilton and Alcan Ingot Alloys in Guelph. These are aluminum smelters which produce aluminum ingots and molten aluminum for manufacturing applications such as the automotive sector. The Alcan plant representative reported that this facility is presently operating near capacity (Dalla Via, Alcan).

Wabush indicated that the majority of scrap aluminum recovered is sold to manufacturers within Ontario. However, some brokers now favour American markets because they pay higher prices for the material. A large portion (reported between 75% and 99%) of Ontario and GTA material is sold by some brokers to companies such as Reynolds, Alcan and MRI, in the United States. One large dealer revealed that for the first time this year, it will sell material to the US to avoid the onerous processing requirements of its previous Canadian end market.

Aluminum Prices
As a world commodity, the price for secondary aluminum varies according to demand price and availability of primary aluminum on world markets. Primary aluminum is used for higher value applications and secondary aluminum cans are used for can sheet production. When demand for primary ingot declines and prices fall, aluminum can prices must fall as well to stay economically viable. Conversely, when primary ingot prices rise, can prices must rise to keep cans from being used in secondary smelters as a substitute for lower grade scrap aluminum such as siding.

In 1992, the price for aluminum cans varied from $770 to $1,100/tonne, and currently stand at $792/tonne. Over the past five years, the price for aluminum cans has risen as high as $1,750/tonne and dropped as low as $500/tonne (Shah, Alcan). Prices for aluminum cans were reported at approximately 41¢ (U.S.) per pound (approximately $900 per tonne) in February, 1994. Aluminum foil prices paid by Alcan Recycling currently range between $330 and $396/tonne (Fuller, Wabash Alloy Ontario).

The value of aluminum scrap offered by metal dealers in and around the GTA varies depending upon the type of alloy as well as the quantity and quality of aluminum being purchased. Scrap is graded, with post consumer at the low end of value and post industrial at the high end. Prices reported range from a low of $640/tonne to a high of $1,210/tonne (Representatives of Canadian Smelters and Dealers). As a general rule, scrap aluminum prices are slightly lower than aluminum can prices.

Aluminum scrap value has also been affected by a worldwide oversupply of aluminum (the inventory of primary aluminum stands at 450,000 tonnes). An element of this problem concerns Russian exports of primary aluminum which have been flooding world markets and reducing prices (which reflects in limited markets for recycled or any aluminum). An agreement reached in December 1993 between Russia and western aluminum – producing nations will reduce capacity by implementing short term production cuts and restructuring Russia's aluminum industry. As countries continue to reduce aluminum production (as committed in November, 1993), world supplies, and hence, prices are considered likely to stabilize (Globe and Mail, March, 1994).

Reduce
Through research and development, the aluminum industry has reduced the weight of the aluminum beverage can by 13% since 1982. Aluminum is now commonly substituted for heavier materials such as steel in cars.

Reuse
There are currently no common reuse applications for aluminum products. Due to the wide diversity of applications for aluminum, reuse will apply only to certain selected items such as siding, window frames, doors and road signs.

Recycle
Alcan has committed to recycling every kilogram of aluminum cans that is recovered. The value of aluminum scrap will always ensure a strong demand for the material. Problems arise, however, if the aluminum can not be economically source separated or recovered from manufactured items such as electrical parts.

Used Beverage Cans Diverted
Alcan Recycling acts as the processor for all aluminum beer cans collected through the Brewers' Retail. Approximately 80% of all aluminum cans handled by Alcan is from the Brewers' Retail. Alcan also receives the majority of aluminum cans collected through municipal curbside recycling programs, plus cans that are collected by social institutions (e.g. schools) or private companies (e.g. private recyclers).

The total quantity of aluminum cans recovered in Ontario in 1992 was 6,510 tonnes. Alcan recovered 4,954 tonnes while all other sources handled 1,556 tonnes (Confidential Client, 1993).

The industry has claimed that the provincial tax on aluminum beer cans has reduced beer can sales by 40% in Ontario. As a result, it is anticipated that recovery will have declined in 1992 and for the foreseeable future.

Other (non-can) Aluminum Diverted
Wabush reports its annual intake of scrap aluminum at approximately 41,000 tonnes per year (Fuller, Wabash Alloy Ontario). Wabush collects scrap aluminum from selected generators such as McDonnell Douglas. Wabush also purchases aluminum from a network of scrap metal dealers, such as Triple M and Waxman Recycling, as well as several demolition firms.

Federated Genco purchases scrap aluminum from the GTA (and other areas) for melting and production of aluminum ingots. The volumes handled by Federated were not available from the company's representative.

Alcan, Guelph processes approximately 72,000 tonnes/month for the production of foundry alloys for items such as automotive casting. Aluminum foil is also melted into aluminum ingots at the Alcan facility in Guelph. This company was unable to estimate the percent of the material they receive that would have been generated in the GTA.

Future Market Trends for Aluminum

Prices for aluminum are volatile, but are presently beginning to rise again after a brief slump. One broker reported a 25% increase in demand for scrap aluminum, while another reported operating at 50% capacity, with serious concern for the future. The key lies in providing high grade materials and operating in a healthy economy in general. For instance, since the scrap smelters in Ontario are closely tied with the automotive industry (Wabush indicated that 80% of aluminum produced by the company is sold to the automotive sector) the continued strength of secondary aluminum markets will be heavily dependent on this upstream market.

Aluminum is a highly valuable metal which is traded throughout world commodities markets. The inherent value of aluminum ensures that there will always be a strong demand for aluminum cans and other aluminum scrap products. End markets including aluminum can sheet manufacturers and secondary aluminum smelters will continue to exist.

Industrial and manufacturing applications for aluminum are extensive. Because of this, it is anticipated that aluminum will be used in more applications in the future for its light weight and non-corrosive properties.

Market Outlook for GTA Generated Aluminum

Given that several brokers are presently selling aluminum scrap to American processors in the U.S., it is predicted that there will be adequate capacity in local mills to service the GTA market for the foreseeable future.

H5.3 White Goods

Definition

White goods consist of metal household and industrial appliances such as refrigerators, freezers, stoves etc. They are often composed of a mix of materials and may require additional pre-processing prior to marketing to end-users.

Current White Goods Markets Overview

In the GTA, the white goods recycling industry is dominated by three companies including International Iron & Metal Inc. (Hamilton), I.Waxman & Sons (Hamilton), and Inland Iron & Metal (Georgina). A number of metal shredders in GTA also accept white goods. The shredding industry has a capacity to accept significantly more white goods than are currently in supply.

Most residents in the GTA are provided with some form of curbside collection of white goods. For those households without curbside service, a drop-off service is available. Scrap metals are usually stored at landfills before they are taken to scrap dealers for shredding and recycling without salvaging parts or recovering CFCs or capacitors. The steel industry then incorporates the material back into steel products.

A network of several scrap dealers reuse and recycle GTA white goods. P&F Technologies, Brampton, and D.S. Fraser, Oakville are specialized private collectors and appliance trade-in centres that recover CFCs. Brampton, Etobicoke, Mississauga and Richmond Hill recover

CFCs and/or compressor oil before sending the white goods to the scrap dealers. Other municipalities store white goods without processing until scrap dealers collect the material.

Scrap dealers prefer white goods that are free of CFCs or capacitors which may contaminate metal shredder fluff. The fluff is a by-product of the metal shredding process of recycling white goods. It is considered a valuable material in some regions in North America for use as landfill cover. Some concerns have been raised about the potential presence of PCBs in some capacitors which are shredded along with the white goods. (CH2M Hill, 1990)

White Goods Prices
The price paid for white goods varies. Some depots in the GTA will accept white goods at no charge although most charge a tipping fee.

The shredding industry pays between $30-$50 per tonne (including collection) for white goods without compressors.

Reduction
The New Inorganic Materials Science (NIMS), was recently developed for use as a filler, reducing the overall proportion of metallic materials in household appliances produced in 1989 (CH2M Hill, 1990). When these appliances enter the waste stream in years to come, the overall tonnages of white goods may decrease along with the metallic content.

Reuse
White goods are reused both formally and informally by various groups within the GTA. Exchange days or community garage sales in East York and Richmond Hill allow residents to reuse white goods, regardless of condition. Service organizations (eg. Goodwill and the Salvation Army) accept white goods in good condition for resale. Private salvage yards repair appliances with minor problems for resale and the others are stripped down for parts. The remaining scrap is then sent to a shredder for metal recycling.

Recycling
Within the GTA, Halton and York Regions and Metro Toronto have imposed landfill bans on white goods. Most municipalities in the GTA offer curbside collection with access to a drop-off service, while others provide access to drop-off facilities at depot sites.

The use of PCBs ceased in 1977 and over half the white goods with capacitors have been disposed (CH2M Hill, 1990). As a result white goods available for disposal and with the potential to contain PCBs will decline in the future. This will diminish concerns of metal shredders regarding recycling of white goods.

Quantities of White Goods Diverted
In 1990, an estimated 25% (22,000 tonnes) of white goods were processed by the Ontario shredders with the rest being landfilled, stockpiled or recycled using baling processes (CH2M Hill, 1990).

For municipalities in the GTA able to quantify this information (i.e. Halton Region, Brampton, Mississauga, East York, York, Etobicoke and Richmond Hill) a reported 3,340 tonnes of white goods were diverted in 1992 (AMRC, 1993).

H5.4 Current and Future Market Trends for White Goods

In Ontario, about 95,000 tonnes of white goods are available for disposal each year (CH2M Hill, 1990). Of this material, 82% (77,000 tonnes) can be recovered as scrap ferrous metal, 4.6% non-ferrous metals, and the remainder includes glass, plastic, rubber, etc.

The capacity of Ontario's metal shredding industry was 900,000 tonnes in 1990, of which 10%-20% can be appliances and other scrap metal (CH2M Hill, 1990). Therefore, 90,000-180,000 tonnes of scrap metal capacity is available for processing appliances and other scrap metal.

Market Outlook for GTA Generated White Goods

Based on the above discussion, it is anticipated that recycling capacity will always be available for whatever white goods are generated and recovered in GTA.

H6.0 MARKETS FOR CONSTRUCTION AND DEMOLITION WASTE

H6.1 Introduction

Four major industry sectors generate C&D wastes. These include the building construction, renovation, demolition and road construction industries. In the past, construction/demolition wastes were accepted in most landfills due to their relatively inert properties and suitable fill characteristics. One study estimated that C&D wastes are a major contributor to the overall volume of waste disposed in landfills, and contribute up to an estimated 25% by weight of the waste stream. Over the years, many landfill operators and environmental advocates have begun to recognize the inherent benefits associated with diverting C&D waste from landfills (Donovan, August 1991).

Several factors have contributed to the reduction in C&D wastes processed in Canadian cities, particularly the Greater Toronto Area, including:

- decrease in C&D activity due to poor economic conditions;
- significant increase in the volume of C&D wastes exported for landfill; and
- diversion of banned materials (i.e. wood, drywall, OCC, rubble, metals etc.) through the existing recycling infrastructure (MacViro, 1992).

C&D materials, particularly wood waste, drywall, metal, cardboard, and rubble offer good potential for recycling. Problems associated with recycling of C&D wastes occur when hazardous contaminants are mixed in with the recycling stream. Hazardous contaminants include, but are not limited to, asbestos, pressure treated lumber, oil-based paint, and wood treated with creosote (SENES, 1993, Donovan Associates Inc., 1990).

Definition
The construction and demolition (C&D) waste stream is defined as all waste resulting from the construction, renovation and demolition of buildings, roads, bridges and all other structures. The construction waste stream is a mixture of materials including wood, drywall, metals, plastics, asphalt shingles, bricks and cardboard.

A study conducted for Metropolitan Toronto (Proctor and Redfern, and SENES 1991) examined waste generated by the construction and demolition sector. As shown in Table H6.1, wood waste constitutes over half of the waste stream in the construction/demolition sector with wood, aggregate, and building materials comprising the majority of waste stream in the renovation sector. Building materials include drywall, shingles, plaster, ceiling tile, electrical wire and insulation.

Table H6.1
Estimated Composition of Construction, Demolition and Renovation Waste

Waste Materials	Construction (%)	Demolition (%)	Renovation (%)
Wood	31.4	51.8	28.0
Ferrous Metal	8.8	4.7	5.5
Non-Ferrous Metal	0.4	0.5	
Plastic	3.2	0.7	2.4
Glass	4.2		1.4
Paper	5.1	0.4	1.9
Paperboard	6.6	0.3	1.6
Building Materials	17.9	7.9	21.2
Aggregate	19.9	24.7	36.0
Textiles/Rubber/Leather	3.4	0.3	1.6
Fines		8.7	
Special			0.3
(Proctor and Redfern and SENES, 1991)			

Not only do the types and proportions of waste materials vary among the construction, demolition, and renovation sectors, but the amount of waste also varies. The Toronto Home Builders' Association estimates that the quantity of waste generated from renovation activities surpasses the quantity of waste generated by new construction activities by a factor of four.

Generation of Construction and Demolition Wastes in the GTA

C&D waste is generated from several different sources, some of which include:

- road and bridge construction and repair;
- landclearing;
- excavation;
- residential construction, demolition and renovation;
- commercial or industrial construction, demolition and renovation.

Because the activities undertaken vary, the quantity, composition and quality of waste materials change. For example, where landclearing activities will generate tires and stumps (largely organic materials), renovation activities generate all types of materials (tiles, blocks, materials, wood, etc.) much of which may be contaminated. These differences have a significant impact on the ability to successfully market the materials that are salvaged for diversion.

H6.2 Industry Overview

Construction, Demolition and Renovation Industry

The construction industry involves the developers, builders or general contractors and sub-contractors (trades) which construct residential, commercial and industrial buildings. The construction industry in the GTA is represented by the Toronto Construction Association and the Greater Toronto Home Builders' Association which estimates that between 5,000 and 10,000 contracting firms service the GTA. It is estimated that 60% to 70% of these firms are small with the number of employees ranging from 2 to 50 (MacViro, 1992). Unlike the construction and renovation industries, the demolition industry servicing the GTA is dominated by a relatively small number of firms. The GTA is serviced by 4 to 5 main demolition companies with an additional 25 to 30 smaller firms.

The renovation sector consists mostly of small to medium sized companies, with a large number of individual private contractors doing piece-meal work. The Greater Toronto Home Builders' Association estimates that approximately 10,000 licensed renovators operate in the GTA (MacViro, 1992). The number of licensed renovators tends to fluctuate with the buoyancy of the economy and the level of activity in the housing market. Renovation combines both construction and demolition activities.

The C&D industry relies mostly on recycling activities, as opposed to reduction and reuse activities, to achieve diversion of their waste stream. To date, source reduction and reuse initiatives have not significantly contributed to overall waste diversion experienced within the industry (Toronto Construction News, Sept/Oct 1992). The majority of the waste stream consists of drywall, wood, paper (OCC) metal, cardboard, rubble (which may include brick masonry tile, concrete and excavated materials), and plastics. Many of these can be effectively recycled into other products; tile; concrete and excavated materials (MOEE, C&D Waste Reduction Strategy Team, October 1993).

Table H6.2 highlights some typical waste materials found on a construction/demolition site and the typical opportunities for end use.

The degree of separation of demolition wastes is dependent upon contract stipulations, the space available to source separate and the economics of recovering materials. At some projects, the buildings are basically stripped of recoverable metals, wood and brick/concrete. The residual materials (roofing, internal walls, windows etc.) are then disposed as a mixed waste. If a projects calls for a building to be demolished quickly with little opportunity to recover materials the waste rubble, wood, metals and other materials would be mixed and difficult to recover for diversion.

Several barriers have prevented widespread recycling and marketing of C&D materials, as identified in the Ontario C&D Waste Reduction Strategy team report (MOEE, 1993). Some of these include:

- unpredictable material quality;
- inconsistent volumes based on a seasonal industry;
- lack of economic incentive or rationale;
- lack of co-ordination of municipal requirements (landfill bans etc.) as well as some municipalities which prohibit use of various recycled materials;
- job site constraints on source separation.

On the other hand, landfill bans have encouraged diversion of homogeneous wastes generated by the C&D sector. Each of the GTA municipalities have imposed landfill disposal bans for wood, drywall and cardboard. As such, source separation of banned materials takes place at a number of construction sites. Over the years, C&D companies have achieved significant diversion of the quantity of waste going to landfill. Monarch Construction has achieved a 50% diversion of waste going to landfill through source separation and on-site reuse applications (Confidential source).

The cost associated with waste disposal from renovation activities account for almost 10% of the overall costs incurred during the renovation (Globe and Mail, April 10, 1992). There is increasing interest and opportunity for the renovation industry to engage in reuse and recycling activities. Due to the small size of the operations, it is often difficult for renovators to secure markets for their recyclable wastes because relatively small amounts are generated at each specific site. The cumulative effect of renovation activities, however, is significant.

Table H6.2
Typical C&D Waste Materials and Potential Uses

Waste Material	Market Value	End Use/Recycled Products
gypsum wallboard	low	• new wallboard • soil amendment • absorbent media
bricks and blocks	medium	• roadbase/backfill • decorative facades
concrete	medium	• crushed and screened aggregate for: — road subbase — shouldering aggregate — asphaltic concrete — concrete — cement blocks fill
wood - untreated	low	• chipped for: — fuel — landscaping mulch — compost bulking — animal bedding — particle board — manufactured building products — pulp and paper — natural woodchips — timber
wood-treated	low	• same as untreated but potentially unacceptable per hazardous waste standards
plastic (HDPE, LDPE, PS, ABS, PVC)	medium	• chipped/shredded and used to make insulation • plastic lumber • traffic cones • highway barriers
asphalt - shingles - road repair	low	• crushed and mixed with new asphalt to make paving material for roads and bridge resurfacing including: — hot mix — cold mix — road subbase — shouldering aggregate
OCC (including waxed contaminated etc.)	medium	• possible use as with other IC&I OCC
metals	medium	• scrap
glass	low	• fibreglass insulation, sandblast, reflective beads, aggregate
fibreglass	low	• fibreglass
other porcelain	low	• aggregate
carpet	low	• landfill cover
(Source: SENES, 1993, Donovan Associates Inc. 1990 and CMHC, [n.d.])		

The trend in processing recyclable C&D and renovation wastes is to commingle them at the source (with separation from the non-recyclable fraction) and separate the commingled stream at a processing facility. While source separation of individual materials requires less processing resources and equipment, it does not necessarily maximize overall recovery and recycling of the C&D waste stream. Commingled waste processing facilities increase the overall amount of waste diverted from the C&D waste stream, if strict separation requirements are met.

Contamination by hazardous materials continues to be a concern for C&D processors. Hazardous/special waste materials that may inadvertently enter the recycling stream include asbestos, mercury from electrical switches, and PCBs in fluorescent light ballasts manufactured before 1980. Other undesirable contaminants include pressure treated wood, and wood treated with creosote.

There are currently eight facilities located in the GTA that accept mixed (commingled) C&D wastes for processing and several, both within and beyond GTA that accept separated materials for recycling or reuse. Each operation utilizes manual labour and light equipment (Bobcat with grapple) to separate recyclables from the mixed loads. Residual waste materials from these operations have been transferred to landfill sites in the United States until recently. Disposal may occur in GTA with the recent reduction in tipping fees to $50/tonne at landfill and $70/tonne at transfer stations (May, 1994). Table H6.3 identifies the eight commingled C&D processing companies located in the GTA, and describes the materials accepted.

An additional four facilities in Ontario accept clean drywall, and limited drywall from demolition projects. These facilities are:

- Canadian Gypsum Corp. (CGC) - end market capacity of 500 tonnes per year, accepts only clean drywall;
- Domtar (Caledonia) - capacity of 3,600 to 4,800 tonnes per year, accepts only clean drywall;
- New West Gypsum (processor) Westroc end market, (Mississauga) - capacity of 26,000 tonnes per year, accept clean drywall and some drywall from demolition projects;
- Terra Care(Elmira) - capacity of 2,000 to 3,000 tonnes per year, uses the material in the production of cat litter, (McCamley, New West Gypsom, Webber, CGC, Marty, Tema Care).

According to Ira Greenspoon of Canadian Eagle Recyclers, it is critical to maintain a clean supply of C&D waste with low levels on contaminants in order to ensure a healthy market. Furthermore, recycling must remain affordable for the C&D industry to keep separating the materials at the source and to keep the materials in Ontario (Toronto Construction News, Sept/Oct 1992).

The Road Construction Industry
The majority of road construction activity is tendered by the Ontario Ministry of Transportation or Municipal Public Works departments. Road construction and repair wastes are easily separated without contamination. Asphalt, concrete and metal wastes are easily segregated and sent to paving companies for reclamation as Reclaimed Asphalt Pavement (RAP) (MacViro, 1992).

Table H6.3
C&D Waste Processing Facilities in GTA

Company	Capacity (tonnes per year)	Material Processed	Comments
Greater Toronto Area Harkow Aggregates & Recycling Toronto	150,000	wood metal OCC	tipping fee $97 per tonne 7-15% diversion (1993)
Canadian Eagle Recyclers/Greenspoon Demolition Markham	75,000	wood drywall metal OCC used carpet	
Queensway Recycling Etobicoke	not available	mixed office paper OCC wood drywall	tipping fee $110 per tonne (1993)
Teperman Demolition	not available	brick concrete wood metals	
Conwaste Inc. Brampton	not available	wood OCC	manual separation of materials
Delsan Demolition Ltd. Metro Toronto	75,000	wood metal brick concrete	
Hamilton Phillips Environmental	42,000	wood OCC metal asphalt concrete/ brick	20% originates from the GTA asphalt, concrete and bricks must arrive source separated
Laidlaw Waste Systems	44,000	wood OCC drywall metals	12% diversion rate achieved
Lynch, Harkow Aggregates, Mittleman, Canadian Eagle Recyclers, Teperman, Teperman Demolition, Campbell, Conwaste Inc., Tancredi, Delsan Demolition Ltd., Graham, Philips Environmental, Allison, Laidlaw Waste Systems			

The use of Reclaimed Asphalt Pavement (RAP) is established in the GTA. An estimated 50% of the old asphalt is currently reused (MOEE, 1993). In 1990, it was reported that province-wide 1,222,000 tonnes of old asphalt was reused as hot-mix while a further 1,493,000 tonnes was stockpiled (MacViro, 1992). A total of 66 companies, province wide, recover and recycle asphalt (MOEE, October 1993).

In the GTA, 400,000 tonnes of asphalt processing capacity was identified, through a survey of recycling facilities conducted in 1992. The survey found that capacity could be expanded with multi-shift operations and that there appears to be sufficient capacity to process asphalt generated within the GTA (MacViro, 1992). Asphalt processing operations include companies such as Ambro Materials & Construction, D. Crupi & Sons, Fermar Asphalt Ltd., Maple Paving, Miller Paving and Warren Bitulithic Paving.

While processing capacity is available for asphalt, major barriers to recycling this material currently exist and large quantities are being stockpiled since markets are closely linked with the price of oil (MOEE, 1993). The Ontario Ministry of Transportation and municipalities have raised concerns about durability of paved surfaces containing RAP. RAP can represent up to 25% of the material used in road base (HL8) material, but cannot be used in top layer pavement (HL3) (Sizer, City of Brampton).

Aggregate Wastes
Handling and processing of aggregate (i.e., concrete, brick), as well as asphalt is different from other C&D wastes. Aggregate and asphalt wastes traditionally have been source separated from mixed wastes and recovered. Concrete, concrete blocks and bricks are commonly reused as backfill material or sub-base material on the construction job sites, provided it passes a density test to determine its suitability (MOEE, 1994); According to MOEE, Ontario sources of aggregate are being depleted. Thus recycled aggregate from C&D projects would be likely to be marketable (MOEE, 1994, THBA, 1990). However, bricks contaminated with lead paint, or mixed with contaminated rubble are not currently marketable. Since refactory brick contains heavy metals, fluoride and other contaminants these also not marketable (MOEE, October, 1993).

The use of concrete rubble in lakefill applications is a significant landfill diversion practice within the GTA. Both the Toronto Harbor Commission (THC) and the Metropolitan Toronto and Region Conservation Authority (MTRCA) use earth fill, and small and large concrete pieces for erosion control and development of lakeside parks and marinas. In the three years from 1990 to 1992, the THC and MTRCA has used an average of 619,000 tonnes per year of used concrete material as lakefill. Lakefill applications are anticipated to be reduced significantly as some THC and MTRCA projects are nearing completion (Cowey, Metropolitan Toronto and Region Conservation Authority).

H6.3 Prices

In the past, prices charged for processing mixed C&D wastes were competitive with GTA landfill tipping fees ranging, from $97 to $110 per tonne for mixed loads of C&D waste arriving at the processing facilities. These have been comparable with prices charged by private waste hauling companies shipping wastes to the United States where hauling charges, including tipping fees, average $80 to $100/tonne. Recent changes to the tipping fee prices charged at Metropolitan Toronto landfills (reduced to $50) may impact the C&D recycling industry. However, continued diversion will be supported by the 3Rs regulations.

All drywall processing facilities charge a fee to process used drywall, with the exception of Domtar which has an agreement with its hauler to share both costs and revenues from recycled drywall. Fees range from a low of $35/tonne at Terra Care, to a high of $60-70/tonne at CGC, with New West at $65/tonne (refer to Table H6.3 for sources).

H6.4 Trends in C&D Waste Diversion

Very few developments in the handling and diversion of C&D wastes have taken place in the GTA and none are anticipated for the near future. This is primarily due to the lowering of tipping fees. Communications with recycling operators indicate that current tipping fees coupled with a volatile marketplace have hindered decisions to invest in new processing equipment or expansion plans to process C&D wastes.

Legislation and Policies
Several recent policy and legislative initiatives have been introduced with the intention of further promoting source reduction, reuse, recycling and market development of the C&D waste stream.

In March, 1994, the Ontario 3Rs regulations were promulgated. These regulations require the following actions on construction and demolition projects of 2000 sq. m. or greater in floor area:

- source separation of brick and Portland cement concrete, corrugated cardboard, wood, drywall and steel from construction projects;
- brick and Portland cement concrete, wood and steel from demolition projects (MOEE, 1994); and
- development of a waste audit and waste reduction action plan.

Currently, all Ontario government construction and renovation projects require that the contractors sort recyclable debris from non-recyclable debris and promote reuse of construction materials when applicable. The document outlining these waste minimization strategies, entitled *Environmentally Conscious Design for Ontario Government Buildings,* provides direction for ensuring that waste reduction and recycling systems are built into the architectural designs and that waste diversion activities are actively pursued during construction and renovation.

In January 1993, the Ontario Construction Industry announced its *3Rs Code of Practice* which outlines principles and initiatives for businesses to adopt to reduce waste sent to landfills.

Increasingly, the construction and renovation industry is recognizing that opportunities exist to incorporate recycled content building materials into the construction and renovation of buildings. In 1991, the Greater Toronto Homebuilders' Association in association with ORTECH International constructed a "Green Dream Home" showcasing recycled content construction materials and internal furnishings. Increased awareness of recycled content building products will help to rejuvenate the end use market and create new demand for recycled materials (ORTECH, [n.d.]).

Reduce and Reuse
Source reduction at the construction site is a new concept that remains in the early stages of development. According the Toronto Home Builders' Association, however, there is good opportunity to reduce the amount of waste generated on a construction site. The Association found that 10 percent of all dimensional lumber used during construction of residential dwellings is wasted (THBA, 1990). In fact, during the construction of an average sized home, over 2.5 tonnes of new construction waste is generated (ORTECH, [n.d.]).

Reuse, on the other hand, has attracted much attention, particularly within the demolition and renovation industries. It is estimated that the amount of reusable materials generated from renovation and demolition projects is ten times that of recyclable materials generated from new construction. In response, a number of companies have been established as clearinghouses for reusable C&D materials. Materials such as windows, fixtures, lighting, and shelving, which traditionally have been treated as waste items during renovation and commercial leasehold improvement projects, can now be sent to reuse centres for resale.

Two companies have been operating in Canada since 1989, The Reuze Centre in Toronto, Ontario and Envirocycle Expediting in Edmonton, Alberta. These companies not only sell reusable demolition materials at their facility but they offer pre-renovation audits to target and

remove interior and exterior materials prior to renovation or demolition. In three years of operation, from 1989 to 1992, the Envirocycle Expediting centre diverted over 3,000 tonnes of reusable building materials worth $1.5 million at current retail replacement costs (Gerrand, 1992).

Recycle
The greatest opportunities for overall waste diversion remain in the area of recycling. While many of the recycling and end-use processes continue to be as they were in the mid to late 1980s, some new opportunities for C&D recycling are currently being developed.

Over time, advances in technology are likely to continue to open markets for construction and demolition waste. For example, whereas asbestos and window glass had previously been considered un-recyclable, new markets have been developed to divert them from landfill. The MOEE construction and demolition strategy team study (*Keeping C&D Materials out of Landfills*) reports that asbestos can now be formed into a non hazardous fill material. Window glass can be recycled into fibreglass or ground into powder as a component of lime/silica bricks. Paint is also now recycled (MOEE, 1994).

Contractors/drywallers are also becoming more creative in attempting to dispose of off-cuts on-site, by saving pieces which would have once gone to disposal (e.g., large pieces from doors and windows, etc.). Also, some off-cuts are built into interior wall cavities, not placed into dumpsters for disposal. A farmer in the State of Michigan is experimenting with the use of old wallboard as a lime substitute and soil conditioner. The gypsum wallboard is ground to a powder-like substance and then applied to the corn field.

The City of Brampton is conducting a test using a paving asphalt comprised of granulated discarded roofing shingles. The Granulated Bituminous Shingle Material (GBSM) is added to hot mix asphalt and was laid last September 1992. The GBSM is produced by IKO Industries and is comprised on waste shingles which are shredded and the nails are removed (Sizer, City of Brampton).

Technology has been developed to permit on-site recycling of pavement by heating, stripping, and mixing the asphalt in one continuous operation. The process can rejuvenate a road surface to its original state with the need to add nominal amounts of new aggregate and oil. Transportation of new and old materials from the site is thus eliminated.

Market Outlook for C&D Materials
Based on the above discussion, it appears that the private sector is willing to construct additional facilities in GTA to divert C&D wastes, but will not do so as long as export to the U.S., or low tipping fees locally provide a more economical alternative for C&D waste generators. Finding constructive uses for all processed C&D materials will be supported by MOEE guidelines for beneficial uses such as lakefill, backfill, etc. Markets are growing and are likely to continue to expand.

H7.0 MARKETS FOR OTHER MATERIALS

H7.1 Markets for Glass

Introduction
Consumers Glass in Etobicoke is the primary market for colour separated glass cullet in Ontario. The primary end use for colour separated glass cullet is to remanufacture the glass into bottles and jars. Manufacturers of glass containers require stringent separation processes for glass. Currently, glass must be separated at the source into flint, green, and brown glass to ensure product quality. Due to the stringent specifications, effort has been spent to identify and develop alternative end-use markets for mixed glass cullet, including aggregate substitute, sand substitute for sandblasting, manufacture of fibreglass, manufacture of glass tiles, and the use of glass in asphalt.

Definition
The glass industry is commonly separated into three segments: container glass (i.e. bottles and jars), flat glass (e.g. window glass), and pressed or blown glass (i.e. stained glass, glassware, etc.).

Specifications for glass as secondary feedstock vary considerably among the manufacturing applications. Contaminants must be removed and the glass crushed to meet a range of specifications in terms of cleanliness (the absence of contaminants such as bottle caps, labels and other non-glass materials) and coarseness (ranging from a fine powder to coarse glass chunks).

Three colours of glass are commonly produced into bottles and jars. These are:

- Flint glass commonly referred to as clear glass;
- Light blue glass which is also called green glass;
- Amber glass which is also called brown glass.

The Generation of Recyclable Glass in the GTA
The main sources of scrap glass are post-consumer glass (i.e. from residential and IC&I locations) and pre-consumer glass (i.e. from production processes). Over the years, the volume of post-consumer glass available on the market has increased substantially as more communities and IC&I generators implement recycling programs.

Despite the effort to collect glass through the recycling programs, to date, the type of glass accepted in these programs has been restricted to glass containers. Other glass products, such as windows, mirrors, lightbulbs, and ornaments still remain in the waste stream. These materials cannot be easily incorporated into the end-use container manufacturing market due to the incompatible properties of the secondary feedstock.

Table H7.1 shows the quantities of container glass recycled in Ontario from 1989 to 1992 (Paradiso, Consumers Glass), and Blue Box material recovered in 1993 (Symington, Consumers Glass, 1993).

Table H7.1
Quantities of Glass Recycled in Ontario 1989 to 1992 (tonnes)

Source	1989	1990	1991	1992	1993
Ont. Blue Box programs.	30,970	57,541	77,552	81,128	86,165
IC & I (captive depot)	5,798	2,374	3,382	5,097	n/a
Consumers Glass Customers	13,769	14,444	19,621	33,754	n/a
U.S. (1)	8,426	2,628	331	---	n/a
Quebec (1)	4,356	5,275	262	---	n/a
Manitoba (1)	---	---	192	54	n/a
TOTAL	**63,319**	**82,262**	**101,341**	**120,034**	**n/a**

(1) References: U.S., Quebec, and Manitoba sources provide commercial cullet (not curbside or residential.

Consumers Glass estimates that 293,300 tonnes of glass cullet is available in Ontario, of which 80% is residential, and 20% IC&I (Paradiso, Consumers Glass).

Glass Recycling Industry Overview

The majority of glass recovered in recycling programs is sent to Consumers Glass for manufacturing into recycled content glass bottles and containers. Consumers Glass has stated that there is a limit to the amount of cullet which they can handle, but also note that they have projections for increasingly adjusting capacity to handle increasing quantities of recycled glass.

Consumers Glass requires glass containers to be sorted into two separate streams from the residential sector:

- clear (may contain up to 5% light blue glass);
- coloured (may contain up to 5% light blue glass and 5% flint; should not contain more than 5% amber) (Paradiso, Consumers Glass).

Most of the amber coloured glass is collected through the deposit system which applies only to beer bottles sold in Ontario. In the past, contamination by colour and other materials has posed a problems for the glass manufacturing sector; however, the current acceptance rate for loads of recycled glass is 99.3%.

Other companies in the IC&I sector must sort glass according to each colour category (clear, light blue/green, amber/brown). This situation is presenting difficult problems for large generators of recyclable glass, such as bottling companies, which must accommodate the additional storage space requirements to separate the three colours of glass. Smaller companies generally employ recycling firms that separate the commingled glass collected.

Other end-uses for the glass cullet are being explored. For example, the Ontario Ministry of Transportation acknowledges that 5-10% crushed cullet can be used in granular 'B' subbase (crushed to 3/4") (Kennepohl, OMT). At this rate, the demand for recycled glass cullet could reach up to approximately 1,200 tonnes of crushed glass per mile of resurfaced road (Paradiso, Consumers Glass). To date, recycled glass has been used as an aggregate substitute by the following GTA municipalities:

- Metro Toronto: 5,000 tonnes/year;
- Region of Durham: 4,071 tonnes (all of the glass collected in 1992).

A number of Northern Ontario municipalities are also exploring alternative uses for glass.

Glass is also being used as an abrasive for cleaning or preparing surfaces for painting or treatment, replacing the chemicals and sand traditionally used for these purposes. Scrap container glass ground as a fine abrasive has proven just as effective with fewer problems for worker health.

Prices
The amount of glass cullet purchased is conditional upon sales. Consumers Glass has experienced a loss of customers to American and Mexican glass producers. The range of prices paid for glass cullet over the past 3-4 years, by Consumers Glass is shown in Table H7.2.

Table H7.2
Prices Paid for Recycled Glass 1989-1993
$/tonne (2,200 lbs)

	1989	1990	1991	1992	1993
Flint (clear)	66-83[1]	83-66	66	47	47
Coloured (green)	66-83	83-66	66	42	42
Mixed	$44	17-11	11	not accepted	not accepted

1. A $16/tonne premium was paid between October 1989 and March 1990 to encourage colour sorting.

Reference: Paradiso, Consumers Glass

The prices paid for contaminant-free, colour sorted glass, are equivalent to the cost of using virgin materials for the production of glass containers. The higher prices paid prior to January 1, 1992 were to assist the development of the recycling infrastructure.

The current pricing of $47/tonne for flint and $42/tonne for green (coloured) will continue to be paid until further notice. Consumers will provide a written 30 day notice to all recyclers prior to any price changes (Paradiso, Consumers Glass).

Reduce
Over the past several years, many bottle and container manufacturing companies have redesigned the walls of bottles and containers to reduce their weight and thickness. Added strength is achieved by using polystyrene wrap labels that fully encompass the side of the bottle.

Consumers Glass reports that they continuously review the design of their glass containers in order to "right weight" them to use as little glass as possible, while still meeting their customers' requirements.

Consumers Glass plans to reduce the weight of all glass container products by 10% on average between 1988 and the year 2000 (Paradiso, Consumers Glass).

Reuse
Refillable glass containers have been used over the decades for numerous beverage products, including beer, carbonated drinks, and, to a lesser extent, milk. Due to the additional weight of the refillable bottle (approximately 3 times that of a non-refillable bottle) and the additional burden of transportation, the popularity of this reuse approach has decreased over the years. In addition, life cycle analysis studies have not to come to a consensus about the environmental and energy advantages and disadvantages associated with refillable and non-refillable glass bottles.

Recycle
As the end-use markets develop, more glass manufactures have begun to increase the amount of recycled content in their glass bottles and containers. For example, the average recycled content of glass containers manufactured by Consumers Glass over a five year period from 1988 to 1993 has increased substantially. The increases in the recycled content is presented in Table H7.3 (Paradiso, Consumers Glass).

Table H7.3
Recycled Content of Glass Containers
Manufactured by Consumers Glass, 1988 to 1993

Year	Recycled Content	Tonnes of Recycled Glass Used
1988	7%	18,350
1989	13%	36,770
1990	23%	61,730
1991	29%	80,930
1992	32%	86,230
1993 (planned)	35%	90,700

Other potential end-use markets for glass, particularly the aggregate industry, are not as securely established as the glass container manufacturing industry. The use of crushed glass as an aggregate substitute in Ontario will not provide a secure market until a decision is reached about its use and the specifications required. The province of Ontario has not developed specifications governing the use of glass as an aggregate substitute in Ontario. While the Region of Durham is currently experiencing no problems with this use, this is presently a concern for Metro Toronto (Crowley, Durham Region, and Pollack, Metro Toronto).

Other end-use markets being developed include the use of recycled glass cullet in the manufacturing of fibreglass. Some existing manufacturers have been successful in using container and plate cullet in the production of glass fibre insulation. This option has become popular in the Western Provinces; for example, the province of Alberta uses nearly 10,000 tonnes/year of glass in the production of fibreglass.

The use of glass in the production of asphalt offers a potential long-term market for recycled mixed glass. The process of "glassphalt" involves using processed glass as an aggregate substitute for stone or sand in the surface layer of roadways. The process has the potential to consume 60 tonnes of cullet per lane-mile of road construction. Material contamination poses

few problems in this process although there is a slight tendency for reduced traction at speeds over 80 km/hr.

Insulation provides another potential end market for recovered glass. In the U.S., approximately 272,000 tonnes recycled glass were used in the production of thermal and acoustical insulation products (*Resource Recycling*, December, 1993).

In addition, geotextile sleeves filled with crushed glass can be used to replace perforated plastic pipe for various drainage applications such as road underdrain, building foundations, and parking lots. The feedstock is mixed cullet, including container cullet, plate glass and ceramics. The sleeves can also be used to control erosion and have the advantage of being reusable.

Post-consumer glass also can be pressed or blown into new glass products (other than containers) such as tiles, figurines, bowls, and other glassware. Glass reprocessing of this nature is generally considered a form of specialty production that provides local market opportunities, but does not represent an outlet for large quantities of waste glass.

Elsewhere, research is being undertaken to identify recycling opportunities for light bulbs and other glass lighting products. The Canadian Electrical Association has embarked on a project to identify end-use markets and collection opportunities throughout Canada.

Market Outlook for Glass
Glass collection has become a well established part of most recycling programs. However, handling and sorting of glass is problematic at MRFs, and colour sorting places on additional burden on MRF resources.

For these reasons, a number of alternative uses for glass are being explored at this time. Use of glass as an aggregate substitute holds significant potential. The benefit of such uses include a reduction in transportation of glass to Consumers Glass (the only significant market in Ontario) and reduced sorting and handling requirements to remove minor amounts of contamination.

H7.2 Markets for Textiles

Introduction
Markets for used textiles are beginning to expand, and are likely to continue to grow over the next several years. Demand significantly outweighs supply. Although textile reuse (for personal and industrial applications) has long been practiced in some sectors, regular residential collection of the material is still in an early stage of development. Recent data from the Regional Municipality of Ottawa-Carleton's waste composition study indicates that up to 3% (3,200 tonnes) of disposed waste in the city still consists of used clothing, textiles and leather goods (McGregor, Ottawa-Carleton), a finding which corresponds with a study by Franklin Associates (US) that reports textiles as 4.9% of the disposed wastestream. While not a huge portion of the waste stream, it is significant. Waste reduction through diversion of textile waste is expected to expand with the continued growth and development of existing markets.

Definition
In this report, textile is defined as used (or post consumer) clothing and household textiles (sheets, drapes, etc.). It usually does not include vinyls, plastics, leathers, belts, raincoats, luggage, ski gloves, handbags or shoes.

Traditional Textile Market Overview
There are three major markets for used textiles. These include Clothing, Fibre Markets and Industrial Wiping Cloth markets.

Clothing is the largest single use of textiles. Old clothes are sold for domestic and exported markets. Most processors sell a large portion of their output to Third World export markets because of the prohibitively high costs of new clothing in many countries (Haiti, India, Japan, Kenya, Pakistan, Senegal).

End uses of textiles sold as industrial fibre are diverse. One grade of textile (cotton rag stock) is sold to manufacturers of rag bond paper. Some wool garments are sold to manufacturers and rewoven into new garments. Other textile grades are used to pad upholstery and car interiors. Items such as cotton swabs, mops, gauze and mattress pads also often contain recycled fibres. The majority of material sold to fibre markets is exported.

The market for Industrial Wiping Cloth is almost exclusively domestic. Several used textile grades are trimmed and cut for sale to industries for cleaning machinery or spills, and for intermediate or final polishing of products before shipment. Concerns over the cost and environmental impact of virgin wiping cloth products have favoured recycled alternatives in recent years.

Current Textile Market Overview
Waste composition data from the Centre & South Hastings program indicates that approximately 15 kg of textiles/hh/yr are available for recycling (Argue, CSH) while only about 10% of this is presently being captured in the program.

Both domestic and export markets for used textiles are strong at present. As a result of the high cost of new clothing and virgin fibres, domestic demand for used textiles has increased over the past 10 years. (*Resource Recycling* February 1992) In the U.S., the textile processing industry sees a shortage of supply as a major problem. A 1991 report in New York City surveyed 35 textile recyclers and found that all had additional capacity (of up to 30%). (*Resource Recycling* February 1992).

The City of Mississauga is the only GTA municipality currently involved in curbside collection of textiles. A key requirement is that materials must be free of moisture. This demands greater effort and care on the part or residents, in order to make the program successful. Materials

collected are separated at the Mississauga MRF and donated to Goodwill for retail sale, and for sale to salvage dealers as fiber.

Two other Ontario communities are presently collecting textiles at curbside. These include the City of Ottawa and Centre and South Hastings. A Centre and South Hastings study has shown that materials collected are marketed primarily for their highest use, as clothing for export to the Third World (84%). Other textiles are sold as shredded material for mattresses (13%), industrial wipes (2%) and reusable clothing (1%).

Other GTA textiles diversion programs include:

- The Regions of Metro Toronto and Durham have each sponsored the acquisition, refurbishing and placement of staffed collection trailers for Goodwill. The Region of Durham gave Goodwill a capital grant, helped them to locate their trailers, and promoted Goodwill in their public education efforts. While not operating a collection program, the Region was able to divert 1,223 tonnes of material (textiles in addition to other materials), collected from 3 Goodwill drop off sites in Whitby in 1991;

- diversion through the Salvation Army where materials are baled and warehoused prior to shipment to Metro markets;

- textile collection through an igloo depot system in the City of Brampton;

- door-to-door collection by private entrepreneurs, where used clothing is collected and sold to second hand clothing stores or salvagers.

Quality standards for textiles are becoming more stringent. For successful waste diversion, end users have established several specifications that must be met, as defined by the intended market. These include:

- textiles must be undamaged e.g. (not dirty or containing mildew);

- material must be trimmed (e.g. with buttons and zippers removed, etc.);

- textiles must be sorted (there are as many as 150 recognized grades of textiles);

- materials must be baled although some end markets will accept textiles in gaylords, or wrapped in plastic film;

- textiles intended for fibre markets may have to be processed through a tearing machine to prepare them for markets;

- minimum load requirements must be met.

Textile Prices
Prices reported to be paid for used textiles (in the three applications) throughout Ontario are relatively consistent. The majority of revenues reported to be received are in the range of $180/tonne.

Diversion Trends
The following programs highlight the trends in textile diversion that have been undertaken in communities across Ontario:

- in 1992, Goodwill diverted about 10,000 tonnes of material (not just textiles) from GTA landfills through 10 Attended Donation Centres (trailers) and 20 stores (Thompson, Goodwill Industries);

- the Ottawa program expects to divert 600 tonnes/yr from landfill (McGregor, Ottawa-Carleton);

- the Centre & South Hastings program captures about 12 tonnes/month (this is equivalent to approximately 1.7 kg/hh/yr, or about 11% of what's available) (Argue, CSH);

- Mississauga currently ships one 5 ton truckload every week or two to Goodwill Industries (Rathbone, Laidlaw Waste Systems);

- the City of Brampton collected 3.2 tonnes of textiles in 1992 through their igloo depot system (Stewart, Brampton).

Consistent with other programs that reuse textiles, Goodwill Industries report that they could handle significantly more material. Textile recycling is proving however, to be a seasonal activity. Demand is not steady, rather, the bulk of textiles are collected in spring and fall when homeowners dispose of clothes and rags as a by-product of house-cleaning projects.(*BioCycle*, February 1992)

Reduction
Despite efforts to promote source reduction, to date, little focus has been applied to textiles. Public education could well be directed toward extending the life of textiles, encouraging individuals to buy fewer, better quality garments which will last longer.

Reuse
Community agencies like Goodwill offer not only waste reduction benefits, but other community benefits such as work training programs, that can help people gain employment. There is a trend toward increased co-operation between these types of groups for ensuring full use of these products. Relationships between municipalities and community agencies can be very effective and efficient vehicles for diverting waste. For example, it has been suggested that periodic donation of municipal collection resources to assist these organizations would further promote development of reuse opportunities. Municipal sponsorship of reuse/charitable organizations will ensure continued growth of opportunities for reuse (i.e. through sponsorship or assistance with vehicles for charitable organizations).

Recycling
Centre and South Hastings operates its textile diversion program as an employment project for severely disadvantaged workers. This is a successful model that would lend itself well to the labour intensive nature of the preliminary processing involved in textile recycling.

To maximize recycling of textiles for the GTA, private recycling firms may require encouragement to locate in the Greater Toronto Area. Industry expert Ed Stubin manages a textile recycling plant in New York. He maintains that an economically viable operation must have integration of all three functions, since customers buy by the trailer load. This type of diversified operation would be probably be a viable venture for the GTA. Half of the textiles in his operation are sent overseas, the rest of the material is split between fiber uses and wiping cloths. His New York facility handles 12 million lbs/yr (approximately 5,400 tonnes/yr).

Market Outlook for GTA Generated Textiles

The required infrastructure for reuse and recycling of textiles, both post-industrial and post-consumer, is available to absorb the amount of textile waste currently generated in the GTA. Textile diversion requires care and attention on the part of residents. However, ongoing projects in Mississauga, Centre and South Hastings and Ottawa show that this need not be a barrier to increased waste diversion. Assuming maintenance of steady demand for fibres and wiping cloths, and increased demand for used clothing, the market should continue to grow. An improved collection system and fully developed infrastructure should ensure that textiles markets will remain strong and make textile diversion a viable element of the GTA 3Rs waste diversion system.

H7.3 Markets for Wood Waste

Wood waste is generated by many different sources. It is a not a homogeneous waste material and is found in a wide variety of forms, including:

- Broken and whole pallets;
- Crates and boxes;
- Construction and demolition wood (e.g. flooring, dimensional lumber, end-cuts, roof supports);
- Wood chips, shavings and sawdust from manufacturing processes (e.g. furniture, window, door manufacturers);
- Manufactured wood (e.g. desks, doors, paneling etc.);
- Wood scraps and end-cuts;
- Tree stumps and brush; and,
- Miscellaneous forms such as cable spools, telephone poles, railway ties.

Current Markets for Wood
There are a wide range of uses for wood waste. Most end markets require that the wood be reduced to a consistent size such as wood chip, shaving or sawdust. Current end uses found for GTA generated wood wastes include:

- Secondary wood manufacturing;
- Energy recovery;
- Production of fire logs;
- Livestock bedding;
- Mulch and compost; and,
- Recreational/landscaping uses.

There are approximately 29 operators in the GTA which collect and/or re-process wood wastes into more usable forms (MOEE C&D Strategy Team, 1993). The process operations range from large facilities with multiple shredders, screening and magnetic separation to more simplified operations that utilize mobile tub grinders and screening equipment. There are approximately 30 companies that collect, repair and sell used wood pallets. A number of the larger pallet refurbishers also grind residual wood wastes.

There are approximately 5 companies that provide containers and collect higher value wood wastes such as sawdust and shavings from wood working manufacturers.

Approximately 10 direct end markets are active in handling wood wastes from the GTA. There are also an unknown number of farmers who utilize wood chips and shavings for livestock bedding. The majority of this material is collected by the farmers directly from wood waste generators such as furniture manufacturers.

Wood Specifications
Each end market application requires different material specifications. The specifications can call for particular sizing, wood type, moisture content and usually require material to be contaminant free (e.g. metals, chemical residue, grit and stones).

The Domtar particle board operation in Huntsville, Ontario requires hammer milled hardwood, free of metals and grit, whereas the Northern Globe roofing felt facility in Thorold requires softwood chips or shavings. The Ajax Energy facility requires that wood be free of contaminants such as plastics and food waste, but can accept nails in pallets and boxes. Fire log manufacturers tend to have much tighter specifications including type of wood, contamination levels and moisture content.

Applications where the wood will be used as mulch/compost or for landscaping also have strict specifications for contaminant free material including chemical residue and metals.

Quantities of Wood Diverted

Based on estimates provided by the end markets contacted, an estimated 94,000 tonnes of wood waste are being recycled from the GTA through secondary wood manufacturing and energy recovery applications. An unknown quantity of wood waste is utilized as livestock bedding and landscaping applications.

A high degree of pallet reuse takes place in the GTA. There are approximately 30 pallet reconditioners in the GTA that repair wood pallets for resale.

Current and Future End Uses of Wood

There are three end markets which utilize wood waste from the GTA as a feedstock in a manufacturing process. The largest operation is IKO Industries in Brampton, which utilizes wood chips in the manufacture of roofing felt for the building industry. IKO has the ability to receive 30,000 tonnes of wood chips annually, however, they are having difficulties in securing suppliers (Warner, IKO Industries).

Northern Globe (formerly Domtar) is a another manufacturer, located in Thorold, which uses wood chips, together with corrugated cardboard in the production of roofing felt. The facility handles about 13,500 tonnes of wood chips per year (Palento, Northern Globe).

Domtar operates a particle board manufacturing facility in Huntsville. Domtar sources secondary wood waste from two suppliers in the GTA and has a current capacity of 11,000 tonnes per year (West, Domtar Particle Board). Combiboard in Bancroft, which was producing a manufactured particle board, went out of business in 1991.

Can-Fibre has plans to locate a facility in Halton to utilize wood waste in the manufacture of a medium density fibreboard. The facility will handle between an estimated 91,000 and 118,000 tonnes of waste wood and boxboard. The process will use a blend of wood waste and boxboard with the goal by 1998 to have a 50/50 blend of materials. (Kyle, Can-Fibre).

Utilizing wood waste as an energy source or for the production of fuel pellets or fire-logs is the second type of end market for GTA wood wastes. Ajax Energy Corporation burns wood wastes to produce steam for sale to local businesses. Ajax utilizes approximately 30,000 tonnes per year of wood waste (Saab, Ajax Energy Corp.).

Some manufacturers also use wood wastes that are generated for internal heating requirements. Fire log manufacturers such as Bauman Woodfuel (2,500 tonnes per year) (Bauman, Bauman Woodfuels), Conros Corporation (20,000 tonnes per year) (Dias, Conros Corporation) and Monto Industries (2,000 tonnes per year) (Ferrier, Monto Industries) use wood waste in the production of fire logs for retail sale. Fire log production is seasonal in nature, with most activity between June and September.

Wood wastes are also used extensively by the farming community as livestock bedding. This end market outlet varies seasonally and the farmers tend to work out agreements with local wood waste generators. The farmers that require the wood waste for livestock bedding tend to be located within or just outside of the GTA. RT Recycling in Stoney Creek produces a bagged sawdust-like material for agricultural uses. RT consumes an estimated 5,000 tonnes per year (Kahne, RT Recycling).

Some wood wastes are used in mulch or composting applications. Miller Waste Systems of Markham accepts clean loads of wood waste at their facility in Markham. The wood is

stockpiled and a grinder is rented on a quarterly basis to produce a wood chip that is used at the Region of York's yard waste composting facility (Verhoff, Miller Waste Systems). White Rose Nurseries composts lumber mill wastes at their operations in Uxbridge. They use wood waste generated from outside the GTA due to limitations of local suppliers in providing a clean, consistent material.

Recreational applications of wood waste include use on walking trails and in parks by local and provincial governments and Conservation Authorities, while operations utilize wood chips in garden and landscaping applications.

Metro Toronto Works Department will be issuing a request for proposals to collect wood wastes at Metro transfer stations. Metro has had discussions with two companies that have plans to use wood waste. Molded Strandboard is planning to use wood waste in the production of a molded pallet (Innes, Metropolitan Toronto Works Department).

On-Site Energy is a 20 mega-watt wood burning facility located in Chataqua, New York. The facility has the capacity to handle 91,000 tonnes per year and currently sources material from lumber mills and manufacturing operations in New York City, Montreal and Cornwall. On-Site has been actively trying to secure a supplier from the GTA for over two years. They are willing to accept an estimated 18,000 to 23,000 tonnes/year from GTA suppliers. The 315 mile distance and the $9 – $10 per tonne offered for the wood appears to be the prohibitive factors in securing contracts with GTA supplier (Dowd, On-Site Energy).

Supply and Demand of Wood
Demand for clean wood waste material appears to be strong. For example, IKO Industries expanded their felt mill capacity to handle more wood waste material, and now cannot locate sufficient quantities of suitable wood waste. RT Recycling and Conros also expressed some problems in getting suitable material on a consistent basis.

Based on the discussions with the wood waste end markets and wood waste processors, the most limiting factor currently is the diversion of wood waste through illegal operations and transfer of waste to landfill disposal in the United States.

Wood Prices
The prices for disposing of wood waste vary throughout the GTA. Farmers, for example will arrange to have the wood waste collected from a generator at no or nominal costs to the generator. Other locations such as the WCI, Wood Waste Solutions and Ajax Energy charge tipping fees that range from $30/tonne up to $75/tonne (Yeats, Wood Waste Solutions and Erwin Leonov, Waste Conversions Inc.). The processors also tend to provided variable rates depending on the type of wood waste, volumes generated and levels of contamination.

Those contacted have said that the tipping fees charged have gone down considerably due to the low tipping fees being charged by legally and illegally operated transfer operations.

The prices paid by end markets for clean wood product ranges from $10/tonne to $55/tonne. Transportation costs are an important factor to consider when hauling wood waste

Reduce
The introduction of alternative shipping containers such as plastic or metal pallets and boxes that compete with wood products will likely reduce the overall generation of wood waste.

The home building industry have been actively involved in education programs to reduce the amount of wood that is wasted through inefficient practices. The Greater Toronto Home Builders' Association has established an ongoing education program with members to implement waste reduction practices during construction such as off-site framing.

Reuse
Reuse of pallets through reconditioning or through pallet rental arrangements will reduce the need for new pallet manufacturing. The Canadian Pallet Council (CPC) is a non-profit association which tracks and monitors the movement of standardized pallets that are used by the consumer products and allied industries. The CPC pallet will last 135 trips if properly repaired to CPC specifications.

Recycle
Domtar could increase the percentage (from 10% of production to 20%) of GTA sourced wood waste in their process if quality and quantities could be improved and assured.

It is unlikely that new or existing wood waste processors or end markets will significantly increase their capacities to accept more material over the next year. This is primarily because illegal operations are charging much lower tipping fees as they tend to operate simple transfer operations with little separation. If the flow of wood waste could be stemmed at the border and landfill disposal bans are enforced at GTA landfills, there will be a greater demand for processing capabilities and suitable end markets.

Imports and Exports
A limited amount of wood waste is imported into the GTA for the production of fire logs. This is mainly due to the high quality specifications required by some manufacturers. The imported material tends to come from Eastern Ontario and Quebec paper mills.

The export of IC&I wastes to the United States has greatly reduced the volume of wood waste available in the GTA. Reports from the wood waste producers indicate that a high volume of wood waste is simply being sent for landfill disposal in the United States.

H8.0 MARKET DEVELOPMENT

H8.1 Introduction

Market development for recyclables is the key issue in making the recycling process work. All too many recycling programs have proven unsuccessful or become the target of criticism because once collected, markets were not available for productively using the materials. The need to identify new markets for materials, and in particular, to find value-added uses for the resources recovered is a crucial feature in planning for waste diversion. Each alternative system discussed in the 3Rs Analysis assumes that market development will occur, as this feature is crucial in ensuring that increased diversion can be achieved. Market development must go hand in hand with infrastructure and system development because if markets do not keep pace with diversion the material will need to be landfilled, reducing actual diversion achieved.

The actual meaning of market development tends to vary. For some, market development is a technological and capacity issue - where the key to increasing the marketability of recyclables lies in developing new technologies to utilize the materials and work around any contaminants or problems that may be inherent in recovery processes, or in providing increased processing capacity by a variety of incentives.

The more widely accepted definition regards market development as a policy issue. It focuses on defining effective policy instruments that will encourage greater utilization of secondary materials, and removing barriers that constrain or act against seeking out new and profitable uses. The policy elements address technological and economic issues, as well as those related to public perceptions of recycling.

In the United States, the National Recycling Coalition has released a report by its Market Development Committee which focuses on determining which policies will work at the State, Federal or local level to enhance the economic viability of recovered materials. The report specifies six key policy options that could help increase demand, which include:

- virgin material fees;
- minimum content standards;
- material specific utilization requirements;
- manufacturers' responsibility (product stewardship);
- shared responsibility (product stewardship with government support);
- development of a national secondary material utilization trust fund.

Of these, the minimum content-related options were most favourably viewed by NRC since forms of these already exist in many jurisdictions throughout the country. (*Recycling Today*. November 1993).

Market development policies and activities maintain several key characteristics. These include:

- many secondary materials are internationally traded commodities;
- recyclable materials are usually sensitive to the price gap between virgin and secondary material;
- recyclable materials (especially packaging) are sensitive to the strength of the global economy;
- consumer choices and environmental regulations are beginning to have an impact on secondary material markets;
- the development of markets for secondary material are constrained by technical and quality control issues.

H8.2 General Approaches to Market Development

This section of the report explains some of the policy initiatives that have been considered or implemented in various jurisdictions to create demand for secondary materials, including:

- minimum content requirements;
- minimum utilization requirements;
- tradable recycling credits;
- product stewardship;
- government procurement;
- tax credits and exemptions;
- grants and loans;
- market development zones;
- co-operative marketing;
- virgin materials taxes;
- local market development;
- removal of existing subsidies on virgin materials.

Minimum Content Requirements

Minimum content requirements establish an amount of recycled material that must be included by manufacturers in designated products or materials. The amount is usually expressed on a percentage basis (e.g. minimum 50% recycled content in newsprint). The requirements are normally applied to specific products (e.g. newsprint) or packages (e.g. glass bottles), although they may (in theory) be applied across a broad category of products/packages (e.g. all plastic packaging).

Minimum content requirements may be mandatory (i.e. implemented through legislation or regulation) or voluntary (i.e. implemented through a cooperative industry/government agreement).

Experience with minimum content requirements in Canada is limited. The City of Toronto enacted a recycled content by-law for newsprint in 1990. The by-law originally stated that all newspapers sold in boxes on city streets must contain 50% recycled content by July 1, 1991. Following strong opposition by the newspaper publishing industry, the requirement was changed to 15% recycled content by June 1, 1993, 30% by June 1, 1995, and 40% by June 1, 2000.

Minimum content legislation is much more common in the United States. At least nine states now have minimum content requirements for newsprint. Examples of the range of standards now in place include California (20% by 2000), Connecticut (50% by 2000), Illinois (28% by 1993), Maryland (40% by 1998) and Wisconsin (45% by 2001). In all cases, the content levels are scheduled to increase gradually throughout the 1990s until the standards indicated take effect.

The Clinton administration has also recently established minimum content legislation for federal procurement of paper. With the Executive Order on Federal Acquisition, all federal purchases of recycled printing and writing paper are required to contain:

- 20% post consumer content by the end of 1994; and
- 30% post consumer content by the end of 1999 (Wastelines, December, 1993).

Although this will not immediately affect consumption of recycled paper by Canadian mills (as they are minimal suppliers to the U.S. Government), similar bills in Canada or in other Canadian export markets would significantly increase demand. (Wood, 1994).

Minimum content standards force investments in new or expanded recycled material utilization capacity (e.g. de-inking mills). Experience in the newsprint sector indicates that the impact on investments in market development can be substantial. For example, the number of Canadian newsprint producers using recycled feedstock increased from one in 1989 to 12 in 1992 (GVRD, 1993). This represents a total investment of more than $1 billion, with no overall increase in industry output. Much of this investment has been a response to the trend toward minimum content requirements in the major U.S. newsprint markets. There are some indications that content requirements may also impact markets for other materials, where they apply.

The Canadian government has unofficially challenged minimum content requirements in the U.S., on the basis that this form of legislation is an attempt to dictate to another nation how to carry out its manufacturing processes (possibly a GATT violation). The concept of using minimum content requirements to force the use of locally-generated materials (i.e. generated within the region where they are recycled) raises additional trade concerns, based on the argument that this would give an unfair advantage to local industries over importers.

A related issue concerns the harmonization of existing content requirements. Even if minimum content requirements are acceptable under international trade laws, there will be ongoing pressure from industry to avoid a complicated patchwork of standards varying from jurisdiction to jurisdiction.

Minimum Utilization Requirements

Minimum utilization requirements have been debated and discussed but not yet implemented in practice. They are designed to be imposed on manufacturers, consumer product companies, importers or other responsible entities which would be required to utilize a specified amount of secondary material by a pre-determined date. Utilization would be achieved through a variety of means, including direct use of recycled content products, or contracting other parties to reuse or recycle the designated materials in an acceptable manner.

Utilization requirements are often considered more flexible than minimum content requirements because they allow industries to use recovered materials in a range of end uses. (For example, post-consumer glass containers might be used as aggregate in road construction, incorporated into products such as reflective paint, or remanufactured back into new glass containers.) The products or packages to which the utilization standards apply can be defined broadly (e.g. all plastic packaging) or narrowly (e.g. rigid HDPE containers), depending on the desired outcome of the program, with the requirements applied on a company-specific or industry wide basis.

Utilization requirements have been proposed at the federal level in the U.S. for paper and paper products, and packaging made of glass, aluminum, steel and plastic. For example, U.S. federal legislation proposed in 1992 (Bill S976) incorporated a form of utilization requirements as part of a multiple options system that would allow responsible entities to achieve material-specific utilization targets by implementing any combination of the following:

- using secondary materials in their own products or packaging;
- purchasing credits from other manufacturers who use secondary materials. Tradable credits would provide companies with the option of purchasing credits from other companies exceeding the utilization targets;
- ensuring that the products or packages are reused for a purpose identical to their original purpose;
- reducing the weight of materials used in packages or products (GVRD, 1993).

Similar legislation has been introduced, but not passed, in California.

The potential drawback of this option is that it may create a tendency to move toward lowest-cost material utilization (e.g. use of glass in roadbed), even if other options involving greater value-added approaches are available. This option also raises administrative questions and concerns. The concept implies that all options available can be tracked, monitored and enforced, which could become highly complex if a broad range of products and materials are affected.

Utilization requirements are expected to lead to a more diversified form of market development than minimum content requirements, since a wider range of end uses would qualify (e.g. a minimum utilization requirement for glass could stimulate a demand for glass crushers, specialty glass producers, manufacturers of foam glass block, etc.) A utilization model may generate less opposition from the targeted industries than minimum content requirements due to the increased flexibility.

Product Stewardship (with Market Development)

Product stewardship programs (also known as manufacturers' responsibility programs) transfer responsibility for the management of designated waste products/packages to the producers, importers or other designated "responsible entities" in the private sector. A variety of stewardship models have been proposed and debated and some have been implemented. Product Stewardship programs do not always incorporate market development (e.g. the German Green Dot System) however, this feature is crucial in ensuring that the potential for waste diversion is realized. These programs can significantly increase collection of recyclable materials, but if markets are not prepared to accept and utilize the materials, then their positive affect is reduced.

Stewardship organizations and programs vary widely. The options available range from full stewardship programs, in which the industry takes legal possession of the secondary materials and pays for the entire costs of their management, to partial stewardship approaches, whereby industry participates financially in a joint public/private sector waste management system and does not necessarily become directly involved in the ownership of secondary materials.

The Canadian Industry Packaging Stewardship Initiative (CIPSI) is an example of a prominent Canadian product stewardship program that includes a significant market development component. CIPSI proposes a system of industry levies in which each industry member pays a fee in proportion to the actual costs of managing their packages that would be collected under the product stewardship scheme. This model incorporates an explicit market development incentives that includes a rebate paid to industry members that are able to utilize secondary packaging.

The ultimate aim of CIPSI is to provide incentive and direct investment in the development of strong, stable and economic markets for packaging materials, leading a lower cost and more effective packaging management system. Involved parties would include packaging material industries (to manage post-use future of the material); government (at a federal and provincial level, to assist with research, development and supporting legislation as required) and other interests;

A major concern with traditional product stewardship models has been that they may lead to the formation of secondary material "cartels" or other forms of highly concentrated control over secondary material flows. There are concerns that small and mid-size manufacturers, distributors or reuse/recycling industries may be placed at a serious disadvantage as large industries organize to purchase, market and utilize materials.

Most industry led product stewardship programs do not automatically lead to market development. Left to their own devices, industries that are made responsible for diverting their products or packages from waste will generally seek the most cost-effective method for dealing with those products or packages (which may not include recovered materials). Therefore, a market development component must be built into a plan in order that materials recovered may be productively used. Requirements specifying exactly which reuse or recycling alternatives are acceptable or developing an industry fund dedicated to opening markets development are just two approaches that can be helpful. A blended approach of several different initiatives and types of initiatives can also lead to success.

Government Procurement

Procurement policies and programs encourage or require government agencies to purchase goods which are made from reused or recycled materials. The goal is to stimulate markets for secondary materials, thereby improving the economic viability of recycling programs and industries. Common procurement techniques include:

- procurement goals, which are stated commitments to purchase certain types or amounts of reused or recycled materials;
- set aside policies, which require that certain categories of products (e.g. office paper) must include recycled content;
- price preferences, which specify a premium that will be allowable for purchases of products with recycled content;
- minimum recycled content specifications, which define a minimum level of recycled content to be included in designated products;
- research and development investment to expand the potential for increased utilization of recycled materials;
- information programs to ensure that purchasing agents are aware of reused or recycled alternatives.

Procurement programs are sometimes mandated through legislation or regulations. It is now common practice in the United States for state legislatures to require state, county or local government agencies to implement set asides or price preferences. They may also be implemented in response to a policy directive, or on a voluntary basis or facilitated by the formation of cooperative buying groups or agreements involving two or more agencies. Some government agencies are encouraging procurement of reused and recycled products by companies in the private sector.

In the GTA, The Governments Incorporating Procurement Policies to Eliminate Refuse (GIPPER) is a voluntary procurement initiative involving 12 Toronto-area municipalities, and several provincial and federal government agencies. Several municipalities have adopted GIPPER's Guide to Environmental Purchasing and have put various purchasing practices in place (MOEE, 1993). The City of Toronto has implemented policies to incorporate the use of recyclable and recycled materials, and durable and reusable products in their operations.

In the U.S., the Buy Recycled Business Alliance is an example of a private sector procurement initiative. It has been initiated by the National Recycling Coalition in the U.S., with the help of a $50,000 (U.S.) EPA grant. The initial 25 corporate members announced in the fall of 1992 that they had purchased U.S. $2.7 billion in recycled materials the previous year. The group now has 35 sponsors, and a total of 100 companies have committed to increasing their

purchases of recycled materials. All of the core members contribute $5,000-15,000 (U.S.), depending on annual revenues. Other companies do not have to contribute cash, but must sign a pledge to buy recycled products and complete a survey on their procurement practices (*Resource Recycling*, March 1993).

Effective procurement policies are generally considered an important, if not essential technique for stimulating the growth and stabilization of newly emerging markets for recycled materials. Governments, including all contractors and organizations using public funds, as well as government agencies which consume a significant portion of the goods and services in the economy, are a powerful purchasing block. Local governments may play a particularly important role in local market development by targeting products and materials such as compost, used glass and C&D waste that cannot be cost-effectively shipped long distances.

Market Development Zones

A market development zone is a geographical area which is designated as a preferred location for reuse/recycling industries. Such a zone is intended to become a "green industry" area, where businesses that use secondary materials are able to share infrastructure and services, utilize common sources of secondary feedstock, draw from a pool of skilled personnel, and create a specialized base of industry and employment for the region or jurisdiction as a whole. Specialized programs and incentives, such as tax credits, technical assistance, grants and loans, are usually made available within the designated area so that these resources are concentrated geographically rather than dispersed widely (and perhaps less effectively).

The leading example of the market development zone concept is California's Recycling Market Development Zone (RMDZ) Program. Local municipalities in the state apply to the California Integrated Waste Management Board (CIWMB) to have an area designated as an RMDZ. Businesses locating within an RMDZ are then eligible for low interest loans. They are also eligible to receive tax credits, equipment and technical assistance grants, and assistance with regulatory compliance (i.e. a market zone coordinator in each approved zone is assigned to address regulatory issues). Sixteen RMDZs have been established in California to date (GVRD, 1992).

Some communities in California have reacted negatively to the idea of a market development zone, fearing that it is another name for a garbage disposal area, and that nearby residential areas will suffer declining property values, environmental deterioration and other negative impacts. Communities may be particularly concerned that the zone will become an importer of post-consumer materials from other areas.

The impact of market development zones on actual market development is unclear since practical experience to date is limited. They appear to have potential to play a key role in the development of local "closed loop" economics, in which recyclable or compostable materials are generated, processed, remanufactured and distributed in close geographical proximity. Alternatively (or simultaneously) the zones can become a centre for the export of recycled content products.

To be effective, it is important that these programs be implemented as part of an overall market development plan that focuses on key sectors where market capacity is required. Otherwise, market development zones, like any form of incentive program, can result in overcapacity for some materials and undercapacity for others.

Tax Credits and Exemptions

A variety of tax credits or exemptions may be implemented by governments seeking to stimulate market development through financial incentives. The theory is that qualifying industries are more likely to invest in a particular jurisdiction if tax benefits are available.

Tax credits/exemptions may take several forms, including:

- corporate income tax credits allowable on purchases of equipment or facilities for reuse/recycling;
- sales tax exemptions for purchases of equipment and facilities for reuse/recycling;
- property tax exemptions for buildings, equipment and land used in converting waste into new products;
- exemptions for transportation fees or taxes paid for the movement of recycled materials;
- personal income tax credits for purchase of designated consumer products (e.g. furnaces that burn recycled oil).

Tax incentives such as those listed above may be linked to a market development zone program, as in California. In this case, incentives are available only to industries locating in designated geographical areas.

Tax credits and exemptions applicable to market development projects are becoming common in the U.S. and to a lesser extent, Canada. A selection of programs are summarized as follows to indicate the range of approaches currently in practice:

- the new Canadian Scientific Research and Environmental Development SR&ED program was announced in the 1994 Federal budget. It is focused on assisting small businesses to become involved in scientific research and environmental development. It essentially provides a 35% investment tax credit on up to $2 million per annum of qualifying expenditures for companies with a taxable business income that does not exceed $200,000. The 35% tax credit is fully refundable for current SR&ED expenditures and 40% refundable for capital expenditures. The program is available to Canadian controlled private corporations only (Government of Canada, 1994);
- since 1968, the Oregon Regional Department of Environmental Quality (DEQ) has granted Pollution Control Tax Credits to recycling operations that are constructed to prevent, control or reduce pollution. The program offers investment tax credits that may be taken against personal income tax, corporate excise tax or property taxes in some instances. The DEQ also offers Plastics Tax Credit to companies investing in plastics recycling equipment or machinery and administers a Business Energy Tax Credit Program for projects that conserve energy or use renewable resources.
- manufacturers using secondary materials qualify for tax rebates of up to $300,000 (U.S.) in Wisconsin. Tax rebates of 5-10% are available to companies purchasing equipment or machinery for market development. Rebates are also available to companies making products from recycled materials that are at a competitive disadvantage to companies producing from virgin feedstock.

- individuals and corporations in Virginia may take advantage of a tax credit of 10% of the purchase price of machinery and equipment used for processing recyclable materials. The credit also applies to manufacturing plants that use recycled products. This type of equipment tax credit is also in a number of other states including, Arizona, Kansas and Louisiana (GVRD, 1993).

Government tax credit/exemption and assistance programs are a mechanism for redistributing the tax (and other burdens) of targeted industries. The degree of influence that they may have on purchasing or investment decisions remains uncertain. If tax credits are available in specific geographical areas, as in California, they are likely to influence the location of companies.

In isolation, these programs are not considered likely to stimulate tremendous growth in market development but can be applied effectively in tandem with other options.

Grants and Loans

Programs offering grants or loans are designed to stimulate market development by increasing the availability of financing to reuse and recycling industries. These programs usually respond to real or perceived barriers faced by reuse/recycling industries in securing adequate financing. Several incentives are available including:

- loans which are generally provided for capital expenditures. Options include low interest loan programs and revolving loan funds;

- grants which may be provided for capital expenditures, feasibility studies, research and development, etc.;

- operating subsidies which may take many forms, including full or partial payment for specified operating costs (e.g. transportation subsidies, material price subsidies, etc.);

- bonds which are used to raise capital. Examples may include tax exempt bonds, industrial revenue bonds.

Several other measures may provide indirect support to industries seeking financing, some of which include:

- providing information to the financial industry on industry trends and development, factors affecting business success/failure, etc.;

- creating a voluntary financing network;

- regulatory or administrative changes to improve access to financing through conventional channels.

Other Canadian programs include:

- Environmental Innovation Program
  A federal program that encourages research and development in natural science, social science and health issues to strengthen Canada's environmental science and technology, through the Green Plan. It is available to industry, university and native groups as well as NGOs and individuals. Programs involved may include recycling and market development (Canadian Research and Publication Centre, November, 1993);

- Cooperative Industrial and Market Development Program
A federal/provincial program shared with the secondary wood products industry. Its goals include research into technical problems and technology transfer, along with technology transfer and establishment of quality control systems. Market development projects are applicable for funding under the program, to help businesses get involved in export markets for the wood product sector (DOE/MOEE, May 1993);

- Industrial Waste Diversion Program
A provincial program in Ontario that provides technical and financial assistance for projects designed to use the 3Rs for diverting hazardous and non-hazardous industrial waste. Eligible projects include those which implement new 3Rs processes for IC&I waste; modify existing processes, equipment and operations or demonstrate technology and conduct research into 3Rs for IC&I operations. Up to 50% of costs are available for eligible diversion equipment and 50% of the cost of installation and commissioning may be available. Projects that deal with applied research or demonstrate or evaluate a technology or process may receive up to 100% funding, as determined on a case by case basis (MOEE, 1991). In the 1992/93, the Industrial Waste Diversion Program provided over $8.0 million in funding towards 225 projects (Petoia, MOEE, 1994).

Loan and grant programs have been established in at least 24 states in the U.S. Examples include:

- the State of California which operates one of the most sophisticated loan programs designed specifically for market development. The Recycling Market Development Zone (RMDZ) Low Interest Loan Program makes loans available to businesses involved in recycling and located within a designated market development zone in the State. Loans can finance no more than 50% of project costs up to a maximum of $1 million (U.S.);

- Utah operates a subsidy program linked to the amount of material recycled. The state will pay recyclers $21 (U.S.) per ton for tires that are made into new products or burned for energy;

- the State of Wisconsin Department of Development offers loans of up to $750,000 (U.S.) or 75% of project costs, and grants of up to $250,000 (U.S.);

- the Minnesota Office of Waste Management is very active in market development financing. The first series of market development grants and loans were awarded in 1991. The state received 56 applications for $2 million (U.S.) in assistance, and gave awards to 14 counties, private companies and research institutions;

- the New York State Office of Recycling Market Development offers businesses grants of up to $100,000 (U.S.) for feasibility studies.

Grant or loan programs may play an important role in market development, since a barrier to business start-ups and expansions in this area is limited access to debt and equity financing. Carefully targeted grants or loans may help a jurisdiction attract a particular type of venture that addresses an important market development need (e.g. a plastics processing plant in an area with no existing processing capacity). However, inadequately planned financial assistance programs may result in overcapacities for some materials and undercapacities for others.

Co-operative Marketing

Co-operative marketing generally refers to any arrangement whereby a group of government agencies and/or private companies agree to collaborate to market secondary materials. The basic premise underlying co-op marketing is that members can secure better prices, move materials to markets more efficiently, or find markets for a broader range of materials than would be possible through individual marketing.

Co-operative marketing organizations may provide a variety of different functions or services to members including:

- co-ordination of contracts/agreements to jointly market materials;
- joint purchasing of processing equipment and facilities;
- sharing of facilities, storage space and equipment;
- co-ordination of shipments to markets;
- education and training to improve source separation, processing and material quality;
- joint purchasing of recycled products.

As of June, 1992, there were at least 15 U.S. and Canadian co-operative marketing programs for recyclable materials although only two (the Bluewater Recycling Association in Ontario and the New Hampshire Resource Recovery Association) have more than five years of experience (*Resource Recycling*, September 1992). Relevant details of these programs include:

- the Bluewater Recycling Association represents 40 municipalities and four counties in a predominantly rural region of Southern Ontario. Members purchase from a range of services, including training, curbside collection, processing and marketing. In addition to local governments, membership includes some 500 businesses, 60 schools, two haulers and two private recyclers. About two thirds of the Association's funding is from service fees, and the other third is from grants from the Ontario Ministry of Environment and Energy;
- the New Hampshire Resource Recovery Association (NHRRA) was originally organized in 1983 to serve as a marketing network for 10 recycling programs. It now provides marketing, transportation and technical assistance to more than 174 recycling programs in New Hampshire and several in Maine, Massachusetts, and Vermont, serving a population of more than one million. The NHRRA has agreements with five major end markets purchasing a wide variety of recyclable materials (Agitant, November, 1993).

While co-operatives focus on "marketing" rather than "market development" they may have a significant influence on local investment in markets for recycled materials. It is considered likely that the existence of a strong marketing co-operative may influence the investment decisions of end users, since large, stable supplies of materials with consistent quality is a requirement for most plants.

A large marketing co-op can also become a significant buyer of recycled content materials, potentially stimulating or creating its own end markets. A co-operative may also play a role in procurement. Several of the co-operatives listed above have programs to encourage members to buy reused and recycled products, thereby helping to stimulate markets.

A potential concern related to marketing co-operatives is that they may detract from local market development efforts in some instances. Membership in a co-op may effectively remove responsibility for finding and developing local markets from a local government or non-profit recycling agency.

Co-operative marketing organizations may also displace existing marketing businesses and infrastructure. In some instances, however, co-operatives have been able to work together with existing brokers, haulers and material processors for mutual benefit (as noted above, the membership of many co-operatives includes private sector operators). There is further concern that, depending on how a co-operative is structured, members may have to trade-off flexibility in marketing local materials to participate (e.g. there may be a requirement that certain materials **must** be handled by the co-op, or a restriction on the source separation practices or range of materials collected by members).

Virgin Material Taxes

In this market development approach, virgin material taxes would be imposed on the primary materials used by industry in manufacturing products and packages. Such taxes would increase the cost of primary materials, thereby improving the relative economic benefits of source reduction and secondary materials substitution. Market development would be a direct outcome, to the extent that industries would invest in the technologies, equipment and facilities required to substitute secondary materials for existing primary feedstocks.

Virgin material taxes have the potential in theory to encourage resource efficiency and stimulate an expansion in markets for secondary materials. However, it is unclear how large a virgin material tax would be required to create a significant shift from primary to secondary materials. Further, it may take a long time for a virgin material tax to influence market demand for secondary materials.

A virgin material tax would most likely have to be applied at the national level, in order to capture the majority of primary material consumers in any sector in a fair and non-discriminatory manner. It would not be possible to apply the taxes to all primary materials which contribute to waste generation (such as organics). However, the revenues generated by a virgin material tax may be used to develop markets or expand reuse/recycling systems. Such a tax might be less complex to administer than other tax options (e.g. product and packaging taxes) due to a more limited number of tax paying entities and taxable product categories at the primary resource level.

Experience to date with virgin material taxes is limited and includes:

- the State of Florida currently imposes a fee of $11 (U.S.) per tonne on newsprint, and uses the funds for waste management programs. The Florida measure is generally seen as a fund-raising mechanism only, since this fee is too low to have a significant effect on purchasing decisions.

- a proposal to introduce a virgin materials levy of $8.25 (U.S.) per tonne on designated materials was introduced in the U.S. House of Representatives in 1990 (Bill HR 3737) but failed to pass. A virgin material levy with a rebate for secondary materials substitution has also been discussed at the federal level in the U.S., but never implemented (GVRD, 1993).

This measure has implications for interjurisdictional trade and may be challenged as a non-tariff trade barrier under the Free Trade Agreement. Many analysts (e.g. the Recycling Advisory Committee of the National Recycling Coalition in the U.S.) argue that removal of existing

subsidies that favour primary resource consumption is a preferred and potentially more efficient approach than adding a new tax.

Local Market Development

Establishing local, small and medium scale manufacturing businesses that use recyclables as their primary feedstock is helpful in strengthening the economics for recycling in a region and in promoting local economic diversification. The primary objectives of local market development are:

- to develop local markets for secondary material;
- to create jobs locally;
- to spur local and regional economic growth.

Two main pressures have increased interest in local market development. These include pressures to create jobs (at "affordable prices") within the local economy and the shift in emphasis from focusing on the "supply-push" of growing residential recycling services to pay attention to creating new "demand-pull" end market opportunities.

Local business development, local job creation and offsetting long distance transportation costs are three potential benefits of local market development. However, as with larger scale, more capital intensive market development investments, local opportunities can also be a risk. Many of the initiatives described in this report are new and emerging business opportunities.

One of the key issues in determining the proper market development strategy for each secondary material type (and for the province as a whole) is to seek the right balance between traditional and the relatively new category of local market development.

In Ontario, several initiatives have been undertaken to encourage local market development using recycled materials. The Ontario Ministry of Environment and Energy has sponsored creation of a local market development workshop. The workshop focuses on bringing together local entrepreneurs, recycling officials and potential financiers in order to stimulate local business development. The first such workshop was piloted in the community of Hamilton/Wentworth in June, 1993.

The issue of local market development has gained considerable attention due to the potential for innovation and productive local use of an available commodity. In most cases, local market development initiatives do not compete with the large, industrial uses of recovered materials. However, these initiatives do provide an important and growing market for recovered materials, particularly in areas where transportation to market would otherwise inhibit recovery.

Remove Existing Subsidies on Virgin Materials

A potential market development strategy facilitating recyclable utilization would entail removing existing subsidies that are applied either directly, on resource extraction and manufacturing of virgin materials and associated products, or on the other inputs to these products (such as energy or water). Various federal incentives were originally established following World War I to spur economic development and to help industry to recover from periods of depression. Many were intended to be repealed once the economic situation became more stable. In reality, few have (*Recycling Times*, June, 1993).

A recent study conducted by the U.S. Environmental Protection Agency (EPA) examined a wide range of potential effects on material utilization. The subsidies take the form of percentage depletion allowances, capital gains treatment of income, deduction for expenses,

foreign tax credits, discriminatory transportation pricing, below-cost timer sales and energy subsidies. Failure to internalize the full cost of pollution is another example of a virgin material use subsidy that could hinder recycling.

The report shows energy subsidies as the largest single factor encouraging virgin material use. Because virgin material use is typically more energy intensive than is recycling (e.g. glass, aluminum production), the report finds the subsidies provide more benefit to primary industries.

While the report showed impressive dollar costs attributed to subsidies, as a percentage cost of actual production, they were very small (approximately 1.5% of costs in the paper industry) (*Recycling Times*, 1993). In the U.S., the portion of costs is low due to the low fraction of domestically produced resources used in the production of primary materials (*Resource Recycling*, June, 1992) and it did not account for utilization of resources imported from countries where subsidies are a major factor. Whether, or to what degree this may be different in the Canadian context is open to speculation.

According to the report, on its own, the removal of the virgin subsidies factor would not be the sole determinant in whether a plant would manufacture virgin or recycled fiber, but it may play a part. Also, while annual dollar figures are small, the historical cumulation of subsidies is remarkable. Conversely, in the U.S., where some subsidies have been repealed (such as the capital gains treatment of timber which was repealed by 1986 federal tax reforms), this impact will be felt for years to come.

Based on information available at this time, the potential direct impact on recycling and market development that would be caused by removing subsidies from virgin materials is not clear.

Ontario Ministry of Environment and Energy (MOEE) Material Strategy Team Process

The Waste Reduction Office of the Ontario MOEE established a set of material strategy teams to support and identify barriers to achieving provincial goals of 25% waste diversion by 1992 and at least 50% by 2000. Four multi-stakeholder interest groups have been established to develop strategies for waste diversion, focusing on materials that constitute major portions of the waste stream. This approach has drawn industry together with individuals and government in a "problem solving" exercise to increase potential for waste diversion.. Primary goals of the groups were to develop environmentally sound strategies to divert additional materials from disposal, to promote development of strong and stable markets for the materials and set deadlines for developing the strategies and achieving the goals. The 4 groups formed include;

- Ontario Plastics Strategy Team;
- Ontario Organic Material Strategy Team;
- Paper Fibre Strategy Team;
- Construction and Demolition Waste Strategy Team.

Reports from the latter two teams were released in October, 1993. They summarize major waste diversion activities and practices by various industries, identify general barriers to waste diversion and propose practical action plans to overcome the barriers.

The Paper Fibre Strategy Report (*Keeping Paper Out of Ontario Landfills: Progress and Action*) identifies 19 action initiatives that could be undertaken to increase waste diversion of all types of paper. A selection of some of the initiatives that focus on market development include:

- developing procurement policies to support paper fibre diversion;

- identifying funding sources and research organizations to promote research needs for waste paper diversion;
- design and deliver market development workshops;
- develop markets for low grade secondary paper fibre.

The C&D Strategy Team Report (*Keeping C&D Out of Landfills: Conserving Resources and Minimizing Waste in the Construction Industry*) presents 26 action plans that are designed to incorporate or promote the 3Rs, building on existing sectoral initiatives and provincial efforts for waste diversion. The action plans address issues such as policy requirements, specifications and standards for recyclables and recycling, education needs, technology and infrastructure development and markets. A selection of key initiatives that focus on market development include:

- strengthening and consolidating information resources about recycled materials for the C&D industry;
- expanding, markets by establishing recycled content specifications and performance standards for recycled C&D materials, testing C&D materials etc. through the BUILD GREEN program;
- developing and promoting private and public sector procurement policies that support recycled materials;
- design and deliver market development workshops to encourage local economic development communities to invest in 3Rs ventures;
- developing economic incentives to support recycling.

The Material Strategy Team Action Plans identify lead agencies and suggest timelines for implementation of proposals, and could lead to significant inroads in market development for recovered recyclable materials.

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SCHEDULE I

REGION OF DURHAM ESTIMATES

Table I.1
Existing System
Region of Durham

Component	Residential Waste Generated (Total) (tonnes)	Residential Waste Generated S-F Hhlds (tonnes)	Residential Waste Generated M-F Hhlds (tonnes)	Residential Diversion (tonnes) Standard Blue Box	Residential Waste Landfilled All Households	Comp. of Disposed Waste (%) All Hhlds
Total Residential Waste (tonnes)	140,078	122,346	17,732	36,987	103,091	
Paper						
Newspaper	23,612	20,111	3,502	12,531	11,081	11
Corrugated cardboard (OCC)	3,642	3,102	540	1,446	2,196	2
Telephone Directories	319	272	47	115	204	
Mixed paper	21,786	18,555	3,231		21,786	21
Subtotal (Paper)	49,360	42,040	7,320	14,092	35,268	34
Glass	7,034	5,990	1,043	4,319	2,715	3
Tinplate Steel (ferrous)	5,175	4,486	689			
Aluminum (non-ferrous)	1,382	1,177	205			
Subtotal Metal (commingled)	6,556	5,662	894	3,177	3,379	3
Plastic						
PET	289	246	43	109	180	0
HDPE	490	418	73		490	0
Other Plastic	7,259	6,182	1,076		7,259	7
Subtotal (Plastic)	8,038	6,846	1,192	109	7,929	8
Organics						
Food wastes	31,651	26,957	4,694	2,580	29,071	28
Yard waste	19,981	19,981		9,259	10,722	10
Subtotal (Organics)	51,632	46,938	4,694	11,839	39,793	39
Wood Waste	1,130	963	168	621	509	0
Construction/Demolition Waste	2,135	1,819	317	752	1,383	1
Disposable Diapers	3,768	3,209	559		3,768	4
Textiles/Leather/Rubber	5,778	4,921	857	1,639	4,139	4
Other	4,647	3,958	689	439	4,208	4
Subtotal (Wood - Other)	17,458	14,869	2,589	3,451	14,007	14
TOTAL	140,078	122,346	17,732	36,987	103,091	100

Residential Diversion = 26%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion data provided by Region of Durham Works Department, 1993.
7) Number of backyard composters provided by Region of Durham Staff, 1993.
8) Households: S-F - 97,269; Semi/Town/Row - 22,767; Low Rise - 9,521; M-F - 11,275. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 5 for Region of Durham specific assumptions.

Table I.2
Existing/Committed System
Region of Durham

Component	Residential Waste Generated (Total) (tonnes)	Residential Waste Generated S-F Hhlds (tonnes)	Residential Waste Generated M-F Hhlds (tonnes)	Residential Diversion (tonnes) Standard Blue Box	Residential Diversion (tonnes) Existing/ Committed	Residential Waste Landfilled All Households	Comp. of Disposed Waste (%) All Hhlds
Total Residential Waste (tonnes)	140,078	122,346	17,732	36,987	42,370	97,708	
Paper							
Newspaper	23,612	20,111	3,502	12,531	12,972	10,640	11
Corrugated cardboard (OCC)	3,642	3,102	540	1,446	1,497	2,145	2
Telephone Directories	319	272	47	115	119	200	
Mixed paper	21,786	18,555	3,231			21,786	22
Subtotal (Paper)	49,360	42,040	7,320	14,092	14,588	34,772	35
Glass	7,034	5,990	1,043	4,319	4,471	2,562	3
Tinplate Steel (ferrous)	5,175	4,486	689				
Aluminum (non-ferrous)	1,382	1,177	205				
Subtotal Metal (commingled)	6,556	5,662	894	3,177	3,289	3,267	3
Plastic							
PET	289	246	43	109	113	177	0
HDPE	490	418	73			490	1
Other Plastic	7,259	6,182	1,076			7,259	7
Subtotal (Plastic)	8,038	6,846	1,192	109	113	7,925	8
Organics							
Food wastes	31,651	26,957	4,694	2,580	3,040	28,611	29
Yard waste	19,981	19,981		9,259	13,419	6,562	7
Subtotal (Organics)	51,632	46,938	4,694	11,839	16,459	35,173	36
Wood Waste	1,130	963	168	621	621	509	1
Construction/Demolition Waste	2,135	1,819	317	752	752	1,383	1
Disposable Diapers	3,768	3,209	559			3,768	4
Textiles/Leather/Rubber	5,778	4,921	857	1,639	1,639	4,139	4
Other	4,647	3,958	689	439	439	4,208	4
Subtotal (Wood - Other)	17,458	14,869	2,589	3,451	3,451	14,007	14
TOTAL	140,078	122,346	17,732	36,987	42,370	97,708	100

Residential Diversion = 30%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion data provided by Region of Durham Works Department, 1993.
7) Number of backyard composters provided by Region of Durham Staff, 1993.
8) Households: S-F - 97,269; Semi/Town/Row - 22,767; Low Rise - 9,521; M-F - 11,275. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 5 for Region of Durham specific assumptions.
10) Existing/committed system includes 4,000 new backyard composters
11) Leaf and yard waste service up to the level of service existing in Metro (56.3% diverted) has been assumed as compliance with the 3Rs Regulations
12) Collection service to multi-family households is assumed to increase to 100%

Table I.3
Direct Cost System
Region of Durham

Component	Residential Waste Generated (Total) (tonnes)	Residential Waste Generated S-F Hhlds (tonnes)	Residential Waste Generated M-F Hhlds (tonnes)	Residential Diversion (tonnes) Standard Blue Box	Residential Diversion (tonnes) Existing/ Committed	Quinte Capture Rates (%)	Residential Diversion (tonnes) Direct Cost All Hhlds	Residential Waste Landfilled All Households	Comp. of Disposed Waste (%) All Hhlds
Total Residential Waste (tonnes)	140,078	122,346	17,732	36,987	42,370		60,356	79,722	
Paper									
Newspaper	23,612	20,111	3,502	12,531	12,972	82.40	17,605	6,007	8
Corrugated cardboard (OCC)	3,642	3,102	540	1,446	1,497	63.40	2,086	1,556	2
Telephone Directories	319	272	47	115	119	76.00	216	103	
Mixed paper	21,786	18,555	3,231					21,786	27
Subtotal (Paper)	49,360	42,040	7,320	14,092	14,588		19,908	29,452	37
Glass	7,034	5,990	1,043	4,319	4,471	70.30	4,568	2,466	3
Tinplate Steel (ferrous)	5,175	4,486	689						
Aluminum (non-ferrous)	1,382	1,177	205						
Subtotal Metal (commingled)	6,556	5,662	894	3,177	3,289	61.40	3,739	2,817	4
Plastic									
PET	289	246	43	109	113	83.40	215	75	0
HDPE	490	418	73					490	1
Other Plastic	7,259	6,182	1,076					7,259	9
Subtotal (Plastic)	8,038	6,846	1,192	109	113		215	7,824	10
Organics									
Food wastes	31,651	26,957	4,694	2,580	3,040		10,493	21,157	27
Yard waste	19,981	19,981		9,259	13,419		17,983	1,998	3
Subtotal (Organics)	51,632	46,938	4,694	11,839	16,459		28,476	23,155	29
Wood Waste	1,130	963	168	621	621		621	509	1
Construction/Demolition Waste	2,135	1,819	317	752	752		752	1,383	2
Disposable Diapers	3,768	3,209	559				0	3,768	5
Textiles/Leather/Rubber	5,778	4,921	857	1,639	1,639		1,639	4,139	5
Other	4,647	3,958	689	439	439		439	4,208	5
Subtotal (Wood - Other)	17,458	14,869	2,589	3,451	3,451		3,451	14,007	18
TOTAL	140,078	122,346	17,732	36,987	42,370		60,356	79,722	100

Residential Diversion = 43%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).

2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91

3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990

4) Relative plastics composition based on Beck et al, 1992

5) Household data provided by Hardy Stevenson & Associates, 1994

6) Diversion data provided by Region of Durham Works Department, 1993.

7) Number of backyard composters provided by Region of Durham Staff, 1993.

8) Households: S-F - 97,269; Semi/Town/Row - 22,767; Low Rise - 9,521; M-F - 11,275. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.

9) Refer to Chapter 4 for general assumptions; Chapter 5 for Region of Durham specific assumptions.

Table I.4
Expanded Blue Box System
Region of Durham

Component	Residential Waste Generated (Total) (tonnes)	Residential Waste Generated S-F Hhlds (tonnes)	Residential Waste Generated M-F Hhlds (tonnes)	Residential Diversion (tonnes) Standard Blue Box	Residential Diversion (tonnes) Existing/ Committed	Quinte Capture Rates (%)	Residential Diversion (tonnes) Exp. BB S-F Hhlds	Residential Diversion (tonnes) Exp. BB M-F Hhlds	Residential Diversion (tonnes) Exp. BB All Hhlds	Residential Waste Landfilled All Households	Comp. of Disposed Waste (%) All Hhlds
Total Residential Waste (tonnes)	140,078	122,346	17,732	36,987	42,370		58,291	3,523	61,814	78,264	
Paper											
Newspaper	23,612	20,111	3,502	12,531	12,972	82.40	16,571	1,443	18,014	5,598	7
Corrugated cardboard (OCC)	3,642	3,102	540	1,446	1,497	63.40	1,967	171	2,138	1,504	2
Telephone Directories	319	272	47	115	119	76.00	207	18	225	95	
Mixed paper	21,786	18,555	3,231			13.80	2,561	223	2,784	19,002	24
Subtotal (Paper)	49,360	42,040	7,320	14,092	14,588		21,306	1,855	23,160	26,200	33
Glass	7,034	5,990	1,043	4,319	4,471	70.30	4,211	367	4,578	2,456	3
Tinplate Steel (ferrous)	5,175	4,486	689								
Aluminum (non-ferrous)	1,382	1,177	205								
Subtotal Metal (commingled)	6,556	5,662	894	3,177	3,289	61.40	3,477	274	3,751	2,805	4
Plastic											
PET	289	246	43	109	113	83.40	206	18	223	66	0
HDPE	490	418	73			57.40	240	21	261	230	0
Other Plastic	7,259	6,182	1,076			15.10	934	81	1,015	6,244	8
Subtotal (Plastic)	8,038	6,846	1,192	109	113		1,379	120	1,499	6,539	8
Organics											
Food wastes	31,651	26,957	4,694	2,580	3,040		8,828	561	9,390	22,261	28
Yard waste	19,981	19,981		9,259	13,419		15,985		15,985	3,996	5
Subtotal (Organics)	51,632	46,938	4,694	11,839	16,459		24,813	561	25,375	26,257	34
Wood Waste	1,130	963	168	621	621		559	62	621	509	1
Construction/Demolition Waste	2,135	1,819	317	752	752		677	75	752	1,383	2
Disposable Diapers	3,768	3,209	559						0	3,768	5
Textiles/Leather/Rubber	5,778	4,921	857	1,639	1,639	7.40	1,475	164	1,639	4,139	5
Other	4,647	3,958	689	439	439		395	44	439	4,208	5
Subtotal (Wood - Other)	17,458	14,869	2,589	3,451	3,451		3,106	345	3,451	14,007	18
TOTAL	140,078	122,346	17,732	36,987	42,370		58,291	3,523	61,814	78,264	100

Residential Diversion = 44%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion data provided by Region of Durham Works Department, 1993.
7) Number of backyard composters provided by Region of Durham Staff, 1993.
8) Households: S-F - 97,269; Semi/Town/Row - 22,767; Low Rise - 9,521; M-F - 11,275. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 5 for Region of Durham specific assumptions.

Table I.5
Wet/Dry System
Region of Durham

Component	Residential Waste Generated (Total) (tonnes)	Residential Waste Generated S-F Hhlds (tonnes)	Residential Waste Generated M-F Hhlds (tonnes)	Residential Diversion (tonnes) Standard Blue Box	Residential Diversion (tonnes) Existing/ Committed	Quinte Capture Rates (%)	Residential Diversion (tonnes) Wet/Dry S-F Hhlds	Residential Diversion (tonnes) Wet/Dry M-F Hhlds	Residential Diversion (tonnes) Wet/Dry All Hhlds	Residential Waste Landfilled All Households	Comp. of Disposed Waste (%) All Hhlds
Total Residential Waste (tonnes)	140,078	122,346	17,732	36,987	42,370		73,027	4,839	77,865	62,213	
Paper											
Newspaper	23,612	20,111	3,502	12,531	12,972	82.40	16,571	1,443	18,014	5,598	9
Corrugated cardboard (OCC)	3,642	3,102	540	1,446	1,497	63.40	1,967	171	2,138	1,504	2
Telephone Directories	319	272	47	115	119	76.00	207	18	225	95	
Mixed paper	21,786	18,555	3,231			13.80	2,561	223	2,784	19,002	31
Subtotal (Paper)	49,360	42,040	7,320	14,092	14,588		21,306	1,855	23,160	26,200	42
Glass	7,034	5,990	1,043	4,319	4,471	70.30	4,211	367	4,578	2,456	4
Tinplate Steel (ferrous)	5,175	4,486	689								
Aluminum (non-ferrous)	1,382	1,177	205								
Subtotal Metal (commingled)	6,556	5,662	894	3,177	3,289	61.40	3,477	274	3,751	2,805	5
Plastic											
PET	289	246	43	109	113	83.40	206	18	223	66	0
HDPE	490	418	73			57.40	240	21	261	230	0
Other Plastic	7,259	6,182	1,076			15.10	934	81	1,015	6,244	10
Subtotal (Plastic)	8,038	6,846	1,192	109	113		1,379	120	1,499	6,539	11
Organics											
Food wastes	31,651	26,957	4,694	2,580	3,040		21,566	1,878	23,443	8,208	13
Yard waste	19,981	19,981		9,259	13,419		17,983		17,983	1,998	3
Subtotal (Organics)	51,632	46,938	4,694	11,839	16,459		39,548	1,878	41,426	10,206	16
Wood Waste	1,130	963	168	621	621		559	62	621	509	1
Construction/Demolition Waste	2,135	1,819	317	752	752		677	75	752	1,383	2
Disposable Diapers	3,768	3,209	559						0	3,768	6
Textiles/Leather/Rubber	5,778	4,921	857	1,639	1,639	7.40	1,475	164	1,639	4,139	7
Other	4,647	3,958	689	439	439		395	44	439	4,208	7
Subtotal (Wood - Other)	17,458	14,869	2,589	3,451	3,451		3,106	345	3,451	14,007	23
TOTAL	140,078	122,346	17,732	36,987	42,370		73,027	4,839	77,865	62,213	100

Residential Diversion = 56%

Notes:
1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion data provided by Region of Durham Works Department, 1993.
7) Number of backyard composters provided by Region of Durham Staff, 1993.
8) Households: S-F - 97,269; Semi/Town/Row - 22,767; Low Rise - 9,521; M-F - 11,275. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 5 for Region of Durham specific assumptions.

Table I.6
Mixed Waste Processing System
Region of Durham

Component	Residential Waste Generated (tonnes) All Hhlds	Res. Diversion (tonnes) Exist/Comm + B.Y. Compos.	Residential Waste Landfilled (tonnes)	Recovered for Recycling in MSW Processing	MSW plus E/C Diversion (tonnes)	Recovered for Composting in MSW Processing	MSW plus E/C plus Composting (landfilled)	MSW plus E/C plus Composting (marketed)	Residue Sent to Landfill from MSW Processing
Total Residential Waste (tonnes)	140,078	49,822	90,256						
Paper									
Newspaper	23,612	12,972	10,640	3,192	16,164	6,331	19,330	22,495	1,117
Corrugated cardboard (OCC)	3,642	1,497	2,145	1,073	2,570	912	3,026	3,481	161
Telephone Directories	319	119	200	100	219	85	262	304	15
Mixed paper	21,786		21,786	2,179	2,179	16,666	10,512	18,845	2,941
Subtotal (Paper)	49,360	14,588	34,772	6,544	21,132	23,994	33,129	45,126	4,234
Glass	7,034	4,471	2,562	512	4,984	0	4,984	4,984	2,050
Tinplate Steel (ferrous)	5,175			0	0	0	0	0	0
Aluminum (non-ferrous)	1,382			0	0	0	0	0	0
Subtotal Metal (commingled)	6,556	3,289	3,267	2,149	5,438	0	5,438	5,438	1,118
Plastic									
PET	289	113	177	177	289	0	289	289	0
HDPE	490		490	123	123	0	123	123	368
Other Plastic	7,259		7,259	0	0	0	0	0	7,259
Subtotal (Plastic)	8,038	113	7,925	299	412	0	412	412	7,626
Organics									
Food wastes	31,651	8,286	23,364	0	8,286	19,860	18,216	28,146	3,505
Yard waste	19,981	15,624	4,357	0	15,624	3,921	17,584	19,545	436
Subtotal (Organics)	51,632	23,910	27,721	0	23,910	23,781	35,801	47,691	3,940
Wood Waste	1,130	621	509	0	621	51	646	672	458
Construction/Demolition Waste	2,135	752	1,383	0	752	138	821	890	1,245
Disposable Diapers	3,768		3,768	0	0	0	0	0	3,768
Textiles/Leather/Rubber	5,778	1,639	4,139	414	2,053	0	2,053	2,053	3,725
Other	4,647	439	4,208	0	439	0	439	439	4,208
Subtotal (Wood - Other)	17,458	3,451	14,007	414	3,865	189	3,959	4,054	13,404
TOTAL	140,078	49,822	90,256	9,919	59,740	47,965	83,723	107,705	32,373
	Diversion = 36%				43%		60%	77%	
	(Existing/Committed + BYC)						(compost landfilled)	(compost marketed)	

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion data provided by Region of Durham Works Department, 1993.
7) Number of backyard composters provided by Region of Durham Staff, 1993.
8) Households: S-F - 97,269; Semi/Town/Row - 22,767; Low Rise - 9,521; M-F - 11,275. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 5 for Region of Durham specific assumptions.

Table I.7

Estimated Residential Waste Generation, Diversion and Disposal Requirements For Six Residential Systems

Region of Durham

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Dir. Cost System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Exp. BB System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Wet/Dry System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Mixed Waste Proc. System Diversion (tonnes) (low)	Mixed Waste Proc. System Diversion (tonnes) (high)	Waste Requiring Disposal (tonnes) (low)	Waste Requiring Disposal (tonnes) (high)
Residential System Diversion (%)					26%		30%		43%		44%		56%		60%	77%		
1996	472,382	155,886	1.4%	2,169	41,161	112,556	47,152	106,565	67,168	86,550	68,790	84,928	86,652	67,065	93,171	119,860	60,546	33,857
1997	486,175	160,438	1.7%	2,790	42,363	115,285	48,529	109,119	69,129	88,519	70,798	86,849	89,182	68,465	95,892	123,360	61,756	34,288
1998	500,370	165,122	2.1%	3,446	43,600	118,076	49,946	111,731	71,147	90,529	72,865	88,811	91,786	69,890	98,691	126,961	62,985	34,715
1999	514,980	169,943	2.4%	4,138	44,873	120,933	51,404	114,402	73,225	92,581	74,993	90,813	94,466	71,339	101,573	130,668	64,233	35,137
2000	530,017	174,906	2.8%	4,867	46,183	123,856	52,905	117,134	75,363	94,676	77,183	92,856	97,225	72,814	104,539	134,484	65,500	35,555
2001	545,493	180,013	3.1%	5,635	47,532	126,846	54,450	119,928	77,563	96,814	79,436	94,941	100,064	74,314	107,591	138,411	66,786	35,967
2002	561,420	185,269	3.5%	6,444	48,919	129,905	56,039	122,785	79,828	98,997	81,756	97,069	102,985	75,839	110,733	142,452	68,092	36,373
2003	577,813	190,678	3.8%	7,296	50,348	133,035	57,676	125,707	82,159	101,224	84,143	99,240	105,992	77,391	113,966	146,611	69,417	36,771
2004	594,684	196,246	4.2%	8,191	51,818	136,237	59,360	128,695	84,558	103,497	86,600	101,455	109,087	78,968	117,293	150,892	70,761	37,163
2005	612,048	201,976	4.5%	9,133	53,331	139,512	61,093	131,750	87,027	105,816	89,128	103,715	112,272	80,571	120,718	155,298	72,125	37,545
2006	629,919	207,873	4.9%	10,123	54,888	142,863	62,877	134,874	89,568	108,183	91,731	106,020	115,550	82,200	124,243	159,832	73,508	37,918
2007	648,312	213,943	5.2%	11,162	56,491	146,290	64,713	138,068	92,183	110,598	94,409	108,372	118,924	83,856	127,871	164,499	74,910	38,281
2008	667,241	220,190	5.6%	12,254	58,140	149,795	66,602	141,333	94,874	113,061	97,166	110,770	122,397	85,539	131,604	169,302	76,331	38,633
2009	686,724	226,619	5.9%	13,400	59,838	153,381	68,547	144,672	97,645	115,574	100,003	113,216	125,971	87,248	135,447	174,246	77,772	38,973
2010	706,775	233,236	6.3%	14,603	61,585	157,048	70,548	148,085	100,496	118,137	102,923	115,711	129,649	88,985	139,402	179,333	79,231	39,300
2011	727,412	240,046	6.6%	15,864	63,383	160,799	72,608	151,574	103,430	120,752	105,928	118,254	133,434	90,748	143,472	184,570	80,710	39,612
2012	748,651	247,055	7.0%	17,186	65,234	164,635	74,728	155,140	106,450	123,418	109,021	120,848	137,330	92,538	147,661	189,959	82,207	39,910
2013	770,511	254,269	7.3%	18,573	67,139	168,557	76,910	158,786	109,558	126,138	112,204	123,492	141,340	94,356	151,973	195,505	83,723	40,190
2014	793,009	261,693	7.7%	20,025	69,099	172,569	79,156	162,512	112,757	128,911	115,480	126,188	145,467	96,201	156,410	201,214	85,257	40,454
2015	816,163	269,334	8.0%	21,547	71,117	176,671	81,467	166,320	116,050	131,738	118,852	128,935	149,714	98,073	160,977	207,089	86,810	40,698
Total		4,154,733		208,845	1,097,041	2,848,847	1,256,709	2,689,179	1,790,175	2,155,712	1,833,406	2,112,482	2,309,489	1,636,399	2,483,229	3,194,547	1,462,659	751,341

Notes:

(1) Population data from Durham Regional Official Plan (Report 93-P-128), interpolated and supplied by Hardy Stevenson and Associates, 1994

(2) Population projection multiplied by 0.33 tonnes/capita/year (based on historical data)

SCHEDULE J

METRO TORONTO ESTIMATES

Table J.1
Existing System
Metropolitan Toronto

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion (tonnes) 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	1,069,790	594,768	475,022	201,177	868,613	
Paper						
Newspaper	191,573	97,766	93,807	57,995	133,578	15
Corrugated cardboard (OCC)	29,551	15,081	14,470	2,786	26,765	3
Telephone Directories	3,176	1,625	1,551	1,098	2,078	
Mixed paper	176,168	89,900	86,268		176,168	20
Subtotal (Paper)	400,468	204,372	196,096	61,879	338,589	39
Glass	57,064	29,122	27,942	23,789	33,275	4
Tinplate Steel (ferrous)	40,268	21,806	18,462	18,314	21,954	3
Aluminum (non-ferrous)	11,209	5,720	5,489	387	10,822	1
Plastic						
PET	2,348	1,198	1,150	635	1,713	
HDPE	3,978	2,030	1,948	1,141	2,837	
Other Plastic	58,890	30,054	28,837		58,890	
Subtotal (Plastic)	65,216	33,282	31,934	1,776	63,440	7
Organics						
Food wastes	256,789	131,048	125,741	12,067	244,722	
Yard waste	97,134	97,134	0	76,740	20,394	
Subtotal (Organics)	353,923	228,182	125,741	88,807	265,116	31
Wood Waste	9,171	4,680	4,491		9,171	
Construction/Demolition Waste	17,323	8,841	8,483	1,500	15,823	
Disposable Diapers	30,570	15,601	14,969		30,570	
Textiles/Leather/Rubber	46,874	23,921	22,953		46,874	
Other	37,703	19,241	18,462	4,725	32,978	
Subtotal (Wood - Other)	141,641	72,284	69,357	6,225	135,416	16
TOTAL	**1,069,790**	**594,768**	**475,022**	**201,177**	**868,613**	**100**

Residential Diversion = 19%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates from 1992 Metro Works Annual Report; personal communication with A. Nanda - Metro Works (June/93).
7) Number of backyard composters provided by Metro staff, 1993.
8) Households: S-F - 289,330; Semi/Town/Row - 158,351; Low Rise - 112,057; M-F - 315,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 6 for Metro specific assumptions.

Table J.2
Existing/Committed System
Metropolitan Toronto

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated S-F Hhld	Residential Waste Generated M-F Hhld	Residential Diversion (tonnes) - 1992 Std. Blue Box	Total Diversion Exist/Com (tonnes)	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	1,069,790	594,768	475,022	201,177	221,854	847,936	
Paper							
Newspaper	191,573	97,766	93,807	57,995	63,951	127,622	15
Corrugated cardboard (OCC)	29,551	15,081	14,470	2,786	3,040	26,512	3
Telephone Directories	3,176	1,625	1,551	1,098	1,212	1,964	
Mixed paper	176,168	89,900	86,268		3,500	172,668	20
Subtotal (Paper)	400,468	204,372	196,096	61,879	71,703	328,766	39
Glass	57,064	29,122	27,942	23,789	26,183	30,881	4
Tinplate Steel (ferrous)	40,268	21,806	18,462	18,314	19,981	20,287	2
Aluminum (non-ferrous)	11,209	5,720	5,489	387	422	10,787	1
Plastic							
PET	2,348	1,198	1,150	635	697	1,651	
HDPE	3,978	2,030	1,948	1,141	1,252	2,726	
Other Plastic	58,890	30,054	28,837		0	58,890	
Subtotal (Plastic)	65,216	33,282	31,934	1,776	1,949	63,267	7
Organics							
Food wastes	256,789	131,048	125,741	12,067	14,078	242,711	
Yard waste	97,134	97,134	0	76,740	81,425	15,709	
Subtotal (Organics)	353,923	228,182	125,741	88,807	95,503	258,421	30
Wood Waste	9,171	4,680	4,491		0	9,171	
Construction/Demolition Waste	17,323	8,841	8,483	1,500	1,122	16,201	
Disposable Diapers	30,570	15,601	14,969		0	30,570	
Textiles/Leather/Rubber	46,874	23,921	22,953		0	46,874	
Other	37,703	19,241	18,462	4,725	4,992	32,711	
Subtotal (Wood - Other)	141,641	72,284	69,357	6,225	6,114	135,527	16
TOTAL	**1,069,790**	**594,768**	**475,022**	**201,177**	**221,854**	**847,936**	**100**

Residential Diversion = 21%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates from 1992 Metro Works Annual Report; personal communication with A. Nanda - Metro Works (June/93).
7) Number of backyard composters provided by Metro staff, 1993.
8) Households: S-F - 289,330; Semi/Town/Row - 158,351; Low Rise - 112,057; M-F - 315,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 6 for Metro specific assumptions.

Table J.3
Direct Cost System
Metropolitan Toronto

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion Existing (tonnes)	Residential Diversion Existing/ Committed	Quinte Capture Rates	Total Residential Diversion (tonnes)	Residential Waste Landfilled (tonnes)	Disposed Waste Comp. %
Total Residential Waste (tonnes)	1,069,790	594,768	475,022	201,177	221,854		313,733	756,057	
Paper									
Newspaper	191,573	97,766	93,807	57,995	63,951	82.4	101,220	90,352	12
Corrugated cardboard (OCC)	29,551	15,081	14,470	2,786	3,040	63.4	10,543	19,008	3
Telephone Directories	3,176	1,625	1,551	1,098	1,212	76.0	1,627	1,550	
Mixed paper	176,168	89,900	86,268		3,500		3,500	172,668	23
Subtotal (Paper)	400,468	204,372	196,096	61,879	71,703		116,890	283,578	37
Glass	57,064	29,122	27,942	23,789	26,183	70.3	28,932	28,132	4
Tinplate Steel (ferrous)	40,268	21,806	18,462	18,314	19,981	64.5	20,520	19,748	3
Aluminum (non-ferrous)	11,209	5,720	5,489	387	422	41.0	2,482	8,727	1
Plastic									
PET	2,348	1,198	1,150	635	697	83.4	1,224	1,123	
HDPE	3,978	2,030	1,948	1,141	1,252	57.4	1,570	2,408	
Other Plastic	58,890	30,054	28,837		0		0	58,890	
Subtotal (Plastic)	65,216	33,282	31,934	1,776	1,949		2,794	62,422	8
Organics									
Food wastes	256,789	131,048	125,741	12,067	14,078		48,580	208,209	
Yard waste	97,134	97,134	0	76,740	81,425		87,421	9,713	
Subtotal (Organics)	353,923	228,182	125,741	88,807	95,503		136,001	217,922	29
Wood Waste	9,171	4,680	4,491		0		0	9,171	
Construction/Demolition Waste	17,323	8,841	8,483	1,500	1,122		1,122	16,201	
Disposable Diapers	30,570	15,601	14,969		0		0	30,570	
Textiles/Leather/Rubber	46,874	23,921	22,953		0		0	46,874	
Other	37,703	19,241	18,462	4,725	4,992		4,992	32,711	
Subtotal (Wood - Other)	141,641	72,284	69,357	6,225	6,114		6,114	135,527	18
TOTAL	1,069,790	594,768	475,022	201,177	221,854		313,733	756,057	100

Residential Diversion = 29%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates from 1992 Metro Works Annual Report; personal communication with A. Nanda - Metro Works (June/93).
7) Number of backyard composters provided by Metro staff, 1993.
8) Households: S-F - 289,330; Semi/Town/Row - 158,351; Low Rise - 112,057; M-F - 315,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 6 for Metro specific assumptions.

Table J.4
Expanded Blue Box System
Metropolitan Toronto

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion (tonnes) - 1992 Std. Blue Box	Total Residential Diversion (Exist/Comm)	Capture Rate (%) Quinte	Res. Div. (tonnes) Exp. BB S-F Hhlds	Res. Div. (tonnes) Exp. BB M-F Hhlds	Residential Diversion All Hhlds	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	1,069,790	594,768	475,022	201,177	221,854		268,971	82,893	351,864	717,926	
Paper											
Newspaper	191,573	97,766	93,807	57,995	63,951	82.4	80,559	38,648	119,207	72,365	10
Corrugated cardboard (OCC)	29,551	15,081	14,470	2,786	3,040	63.4	9,561	4,587	14,148	15,403	2
Telephone Directories	3,176	1,625	1,551	1,098	1,212	76.0	1,235	589	1,824	1,352	
Mixed paper	176,168	89,900	86,268		3,500	13.8	12,406	5,952	18,359	157,810	22
Subtotal (Paper)	400,468	204,372	196,096	61,879	71,703		103,762	49,777	153,539	246,929	34
Glass	57,064	29,122	27,942	23,789	26,183	70.3	20,473	9,822	30,294	26,770	4
Tinplate Steel (ferrous)	40,268	21,806	18,462	18,314	19,981	64.5	14,065	5,954	20,019	20,249	3
Aluminum (non-ferrous)	11,209	5,720	5,489	387	422	41.0	2,345	1,125	3,471	7,739	1
Plastic											
PET	2,348	1,198	1,150	635	697	83.4	999	479	1,479	869	
HDPE	3,978	2,030	1,948	1,141	1,252	57.4	1,165	559	1,724	2,254	
Other Plastic	58,890	30,054	28,837		0	15.1	4,538	2,177	6,715	52,175	
Subtotal (Plastic)	65,216	33,282	31,934	1,776	1,949		6,703	3,216	9,918	55,298	8
Organics											
Food wastes	256,789	131,048	125,741	12,067	14,078		32,926	11,538	44,465	212,324	
Yard waste	97,134	97,134	0	76,740	81,425		81,425		81,425	15,709	
Subtotal (Organics)	353,923	228,182	125,741	88,807	95,503		114,351	11,538	125,889	228,034	32
Wood Waste	9,171	4,680	4,491		0					9,171	
Construction/Demolition Waste	17,323	8,841	8,483	1,500	1,122		1,010	112	1,122	16,201	
Disposable Diapers	30,570	15,601	14,969		0					30,570	
Textiles/Leather/Rubber	46,874	23,921	22,953		0	7.4	1,770	849	2,619	44,255	
Other	37,703	19,241	18,462	4,725	4,992		4,493	499	4,992	32,711	
Subtotal (Wood - Other)	141,641	72,284	69,357	6,225	6,114		7,273	1,461	8,733	132,908	19
TOTAL	**1,069,790**	**594,768**	**475,022**	**201,177**	**221,854**		**268,971**	**82,893**	**351,864**	**717,926**	**100**

Residential Diversion = 33%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates from 1992 Metro Works Annual Report; personal communication with A. Nanda - Metro Works (June/93).
7) Number of backyard composters provided by Metro staff, 1993.
8) Households: S-F - 289,330; Semi/Town/Row - 158,351; Low Rise - 112,057; M-F - 315,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 6 for Metro specific assumptions.

Table J.5
Wet/Dry System
Metropolitan Toronto

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion (tonnes) - 1992 Std. Blue Box	Total Residential Diversion (Exist/Comm)	Capture Rate (%) Quinte	Res. Div. (tonnes) Wet/Dry S-F Hhlds	Res. Div. (tonnes) Wet/Dry M-F Hhlds	Residential Diversion All Hhlds	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	1,069,790	594,768	475,022	201,177	221,854		346,879	121,651	468,530	601,260	
Paper											
Newspaper	191,573	97,766	93,807	57,995	63,951	82.4	80,559	38,648	119,207	72,365	12
Corrugated cardboard (OCC)	29,551	15,081	14,470	2,786	3,040	63.4	9,561	4,587	14,148	15,403	3
Telephone Directories	3,176	1,625	1,551	1,098	1,212	76.0	1,235	589	1,824	1,352	
Mixed paper	176,168	89,900	86,268		3,500	13.8	12,406	5,952	18,359	157,810	26
Subtotal (Paper)	400,468	204,372	196,096	61,879	71,703		103,762	49,777	153,539	246,929	41
Glass	57,064	29,122	27,942	23,789	26,183	70.3	20,473	9,822	30,294	26,770	4
Tinplate Steel (ferrous)	40,268	21,806	18,462	18,314	19,981	64.5	14,065	5,954	20,019	20,249	3
Aluminum (non-ferrous)	11,209	5,720	5,489	387	422	41.0	2,345	1,125	3,471	7,739	1
Plastic											
PET	2,348	1,198	1,150	635	697	83.4	999	479	1,479	869	
HDPE	3,978	2,030	1,948	1,141	1,252	57.4	1,165	559	1,724	2,254	
Other Plastic	58,890	30,054	28,837		0	15.1	4,538	2,177	6,715	52,175	
Subtotal (Plastic)	65,216	33,282	31,934	1,776	1,949		6,703	3,216	9,918	55,298	9
Organics											
Food wastes	256,789	131,048	125,741	12,067	14,078		104,838	50,296	155,135	101,654	
Yard waste	97,134	97,134	0	76,740	81,425		87,421	-	87,421	9,713	
Subtotal (Organics)	353,923	228,182	125,741	88,807	95,503		192,259	50,296	242,555	111,368	19
Wood Waste	9,171	4,680	4,491		0					9,171	
Construction/Demolition Waste	17,323	8,841	8,483	1,500	1,122		1,010	112	1,122	16,201	
Disposable Diapers	30,570	15,601	14,969		0					30,570	
Textiles/Leather/Rubber	46,874	23,921	22,953		0	7.4	1,770	849	2,619	44,255	
Other	37,703	19,241	18,462	4,725	4,992		4,493	499	4,992	32,711	
Subtotal (Wood - Other)	141,641	72,284	69,357	6,225	6,114		7,273	1,461	8,733	132,908	22
TOTAL	1,069,790	594,768	475,022	201,177	221,854		346,879	121,651	468,530	601,260	100

Residential Diversion = 44%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).

2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91

3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990

4) Relative plastics composition based on Beck et al, 1992

5) Household data provided by Hardy Stevenson & Associates, 1994

6) Diversion estimates from 1992 Metro Works Annual Report; personal communication with A. Nanda - Metro Works (June/93).

7) Number of backyard composters provided by Metro staff, 1993.

8) Households: S-F - 289,330; Semi/Town/Row - 158,351; Low Rise - 112,057; M-F - 315,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.

9) Refer to Chapter 4 for general assumptions; Chapter 6 for Metro specific assumptions.

Table J.6
Mixed Waste Processing System
Metropolitan Toronto

Component	Residential Waste Generated (tonnes)	Residential Diversion (tonnes) - 1992 Std. Blue Box	Total Residential Diversion (Exist/Comm)	Res. Diversion (tonnes) Exist/Comm + B.Y. Compos.	Residential Waste Landfilled (tonnes)	Recovered for Recycling in MSW Processing	MSW plus E/C Diversion (tonnes)	Recovered for Composting in MSW Processing	MSW plus E/C plus Composting (landfilled)	MSW plus E/C plus Composting (marketed)	Residue to Landfill from MSW Processing
Total Residential Waste (tonnes)	1,069,790	201,177	221,854	248,125	821,665						
Paper											
Newspaper	191,573	57,995	63,951	63,951	127,622	38,286	102,237	75,935	140,205	178,172	13,400
Corrugated cardboard (OCC)	29,551	2,786	3,040	3,040	26,512	13,256	16,295	11,267	21,929	27,563	1,988
Telephone Directories	3,176	1,098	1,212	1,212	1,964	982	2,194	835	2,611	3,029	147
Mixed paper	176,168		3,500	3,500	172,668	17,267	20,767	132,091	86,813	152,858	23,310
Subtotal (Paper)	400,468	61,879	71,703	71,703	328,766	69,791	141,494	220,128	251,558	361,622	38,846
Glass	57,064	23,789	26,183	26,183	30,881	6,176	32,359	0	32,359	32,359	24,705
Tinplate Steel (ferrous)	40,268	18,314	19,981	19,981	20,287	14,201	34,182	0	34,182	34,182	6,086
Aluminum (non-ferrous)	11,209	387	422	422	10,787	5,393	5,816	0	5,816	5,816	5,393
Plastic											
PET	2,348	635	697	697	1,651	1,651	2,348	0	2,348	2,348	0
HDPE	3,978	1,141	1,252	1,252	2,726	682	1,934	0	1,934	1,934	2,045
Other Plastic	58,890		0	0	58,890	0	0	0	0	0	58,890
Subtotal (Plastic)	65,216	1,776	1,949	1,949	63,267	2,332	4,281	0	4,281	4,281	60,935
Organics											
Food wastes	256,789	12,067	14,078	40,349	216,440	0	40,349	183,974	132,336	224,323	32,466
Yard waste	97,134	76,740	81,425	81,425	15,709	0	81,425	14,138	88,494	95,563	1,571
Subtotal (Organics)	353,923	88,807	95,503	121,774	232,149	0	121,774	198,112	220,830	319,886	34,037
Wood Waste	9,171		0	0	9,171	0	0	917	459	917	8,254
Construction/Demolition Waste	17,323	1,500	1,122	1,122	16,201	0	1,122	1,620	1,932	2,742	14,581
Disposable Diapers	30,570		0	0	30,570	0	0	0	0	0	30,570
Textiles/Leather/Rubber	46,874		0	0	46,874	4,687	4,687	0	4,687	4,687	42,187
Other	37,703	4,725	4,992	4,992	32,711	0	4,992	0	4,992	4,992	32,711
Subtotal (Wood - Other)	141,641	6,225	6,114	6,114	135,527	4,687	10,801	2,537	12,070	13,339	128,303
TOTAL	1,069,790	201,177	221,854	248,125	821,665	102,582	350,706	420,778	561,096	771,485	298,305
		Residential Diversion = 23% Exist/Comm + BYC				**Residential Diversion = 33%** MSW Dry Processing			**52%** (compost landfilled)	**72%** (compost marketed)	

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates from 1992 Metro Works Annual Report; personal communication with A. Nanda - Metro Works (June/93).
7) Number of backyard composters provided by Metro staff, 1993.
8) Households: S-F - 289,330; Semi/Town/Row - 158,351; Low Rise - 112,057; M-F - 315,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 6 for Metro specific assumptions.

Table J.7

Estimated Residential Waste Generation, Diversion and Disposal Requirements For Six Residential Systems

Metropolitan Toronto

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Dir. Cost System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Exp. BB System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Wet/Dry System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Mixed Waste Proc. System Diversion (tonnes) (low)	(high)	Waste Requiring Disposal (tonnes) (low)	(high)
Residential System Diversion (%)					19%		21%		29%		33%		44%		52%	72%		
1996	2,346,778	1,126,453	1.4%	15,672	211,833	898,948	233,605	877,176	330,351	780,430	370,501	740,280	493,346	617,435	590,815	812,348	519,966	298,433
1997	2,361,243	1,133,397	1.7%	19,711	213,138	900,547	235,045	878,641	332,387	781,299	372,784	740,901	496,387	617,298	594,457	817,355	519,229	296,331
1998	2,375,797	1,140,383	2.1%	23,799	214,452	902,131	236,493	880,090	334,436	782,148	375,082	741,501	499,447	617,137	598,121	822,393	518,463	294,190
1999	2,390,441	1,147,412	2.4%	27,937	215,774	903,701	237,951	881,524	336,497	782,978	377,394	742,081	502,525	616,950	601,807	827,462	517,667	292,013
2000	2,405,175	1,154,484	2.8%	32,125	217,104	905,255	239,418	882,942	338,571	783,788	379,720	742,639	505,623	616,737	605,517	832,562	516,842	289,797
2001	2,420,000	1,161,600	3.1%	36,363	218,442	906,795	240,893	884,343	340,658	784,579	382,061	743,176	508,739	616,498	609,249	837,694	515,988	287,543
2002	2,431,741	1,167,236	3.5%	40,600	219,502	907,134	242,062	884,574	342,311	784,326	383,914	742,722	511,207	615,429	612,205	841,758	514,431	284,878
2003	2,443,538	1,172,898	3.8%	44,876	220,567	907,455	243,236	884,786	343,971	784,051	385,777	742,245	513,687	614,335	615,175	845,842	512,847	282,180
2004	2,455,393	1,178,589	4.2%	49,193	221,637	907,758	244,417	884,979	345,640	783,755	387,648	741,747	516,180	613,216	618,159	849,945	511,236	279,450
2005	2,467,305	1,184,306	4.5%	53,551	222,712	908,043	245,602	885,153	347,317	783,438	389,529	741,226	518,684	612,071	621,158	854,069	509,597	276,686
2006	2,479,274	1,190,052	4.9%	57,950	223,793	908,309	246,794	885,307	349,002	783,099	391,419	740,682	521,200	610,901	624,172	858,212	507,930	273,889
2007	2,491,302	1,195,825	5.2%	62,391	224,878	908,556	247,991	885,443	350,695	782,739	393,318	740,116	523,728	609,706	627,200	862,375	506,234	271,059
2008	2,503,389	1,201,627	5.6%	66,873	225,969	908,784	249,194	885,559	352,396	782,357	395,226	739,528	526,269	608,484	630,243	866,559	504,511	268,194
2009	2,515,534	1,207,456	5.9%	71,397	227,066	908,993	250,403	885,656	354,106	781,953	397,143	738,916	528,823	607,236	633,300	870,763	502,759	265,296
2010	2,527,737	1,213,314	6.3%	75,964	228,167	909,183	251,618	885,732	355,824	781,526	399,070	738,280	531,388	605,962	636,372	874,988	500,977	262,362
2011	2,540,000	1,219,200	6.6%	80,573	229,274	909,353	252,839	885,788	357,550	781,077	401,006	737,621	533,966	604,661	639,460	879,232	499,167	259,394
2012	2,555,564	1,226,671	7.0%	85,334	230,679	910,658	254,388	886,949	359,741	781,596	403,463	737,874	537,238	604,099	643,378	884,620	497,959	256,717
2013	2,571,223	1,234,187	7.3%	90,149	232,092	911,945	255,947	888,091	361,945	782,092	405,935	738,102	540,530	603,508	647,320	890,040	496,717	253,997
2014	2,586,978	1,241,749	7.7%	95,021	233,514	913,214	257,515	889,214	364,163	782,566	408,423	738,306	543,842	602,887	651,287	895,494	495,442	251,235
2015	2,602,830	1,249,358	8.0%	99,949	234,945	914,464	259,093	890,317	366,394	783,015	410,925	738,484	547,174	602,236	655,278	900,981	494,132	248,428
Total		23,746,196		1,129,429	4,465,539	18,151,228	4,924,503	17,692,264	6,963,955	15,652,812	7,810,339	14,806,428	10,399,982	12,216,785	12,454,673	17,124,692	10,162,094	5,492,074

Notes:

(1) Population data prepared by Hemson Consulting Ltd., Hardy Stevenson & Associates, Mar. 21/94

(2) Population projection multiplied by 0.48 tonnes/capita/year (based on historical data)

SCHEDULE K

REGION OF YORK ESTIMATES

Table K.1
Existing System
Region of York, 1992

Component	Residential Waste Generated (tonnes) All Households	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion (tonnes) 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	196,250	176,898	19,352	54,100	142,150	
Paper						
Newspaper	32,899	29,078	3,822	16,641	16,258	11
Corrugated cardboard (OCC)	5,075	4,485	590	677	4,397	3
Telephone Directories	367	324	42	75	292	0
Mixed paper	30,433	26,897	3,535	69	30,364	21
Subtotal (Paper)	68,774	60,785	7,989	17,462	51,312	36
Glass	9,800	8,661	1,138	5,770	4,030	3
Tinplate Steel (ferrous)	7,238	6,486	752	2,796	4,442	3
Aluminum (non-ferrous)	1,925	1,701	224	91	1,834	1
Plastic						
PET	403	356	47	282	122	0
HDPE	683	604	79	404	279	0
Other Plastic	10,113	8,939	1,175		10,113	7
Subtotal (Plastic)	11,200	9,899	1,301	686	10,514	7
Organics						
Food wastes	44,099	38,977	5,123	3,338	40,761	29
Yard waste	28,890	28,890	0	17,871	11,019	8
Subtotal (Organics)	72,989	67,867	5,123	21,209	51,780	36
Wood Waste	1,575	1,392	183		1,575	1
Construction/Demolition Waste	2,975	2,629	346		2,975	2
Disposable Diapers	5,250	4,640	610		5,250	4
Textiles/Leather/Rubber	8,050	7,115	935	61	7,988	6
Other	6,475	5,723	752	6,025	450	0
Subtotal (Wood - Other)	24,325	21,499	2,826	6,087	18,238	13
TOTAL	196,250	176,898	19,352	54,100	142,150	100

Residential Diversion = 28%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Markham, Richmond Hill and Region of York.
7) Number of backyard composters provided by York Region staff, 1993.
8) Households: S-F - 128,466; Semi/Town/Row - 14,495; Low Rise - 5,410; M-F - 13,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 7 for York Region specific assumptions.

Table K.2
Existing/Committed System
Region of York

Component	Residential Waste Generated (tonnes) All Households	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion (tonnes) Std. Blue Box	Residential Diversion Existing/ Committed	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	196,250	176,898	19,352	54,100	56,981	139,269	
Paper							
Newspaper	32,899	29,078	3,822	16,641	17,788	15,112	11
Corrugated cardboard (OCC)	5,075	4,485	590	677	724	4,351	3
Telephone Directories	367	324	42	75	80	287	0
Mixed paper	30,433	26,897	3,535	69	73	30,359	22
Subtotal (Paper)	68,774	60,785	7,989	17,462	18,665	50,108	36
Glass	9,800	8,661	1,138	5,770	6,167	3,633	3
Tinplate Steel (ferrous)	7,238	6,486	752	2,796	2,989	4,249	3
Aluminum (non-ferrous)	1,925	1,701	224	91	97	1,828	1
Plastic							
PET	403	356	47	282	301	102	0
HDPE	683	604	79	404	432	251	0
Other Plastic	10,113	8,939	1,175			10,113	7
Subtotal (Plastic)	11,200	9,899	1,301	686	733	10,467	8
Organics							
Food wastes	44,099	38,977	5,123	3,338	3,338	40,761	29
Yard waste	28,890	28,890	0	17,871	18,905	9,985	7
Subtotal (Organics)	72,989	67,867	5,123	21,209	22,243	50,746	36
Wood Waste	1,575	1,392	183		0	1,575	1
Construction/Demolition Waste	2,975	2,629	346		0	2,975	2
Disposable Diapers	5,250	4,640	610		0	5,250	4
Textiles/Leather/Rubber	8,050	7,115	935	61	61	7,988	6
Other	6,475	5,723	752	6,025	6,025	450	0
Subtotal (Wood - Other)	24,325	21,499	2,826	6,087	6,087	18,238	13
TOTAL	196,250	176,898	19,352	54,100	56,981	139,269	100

Residential Diversion = 29%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Markham, Richmond Hill and Region of York.
7) Number of backyard composters provided by York Region staff, 1993.
8) Households: S-F - 128,466; Semi/Town/Row - 14,495; Low Rise - 5,410; M-F - 13,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 7 for York Region specific assumptions.

Table K.3
Direct Cost System
Region of York

Component	Residential Waste Generated (tonnes) All Households	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Existing Residential Diversion (tonnes)	Residential Diversion Existing/ Committed	Quinte Capture Rates (%)	Direct Cost Diversion S-F Hhlds (tonnes)	Direct Cost Diversion M-F Hhlds (tonnes)	Total Residential Diversion (tonnes)	Residential Waste Landfilled (tonnes)	Disposed Waste Comp. %
Total Residential Waste (tonnes)	196,250	176,898	19,352	54,100	56,981		82,038	2,872	84,910	111,340	
Paper											
Newspaper	32,899	29,078	3,822	16,641	17,788	82.4	23,960	1,092	25,052	7,848	7
Corrugated cardboard (OCC)	5,075	4,485	590	677	724	63.4	2,844	44	2,888	2,187	2
Telephone Directories	367	324	42	75	80	76.0	246	5	251	115	0
Mixed paper	30,433	26,897	3,535	69	73		66	5	71	30,362	27
Subtotal (Paper)	68,774	60,785	7,989	17,462	18,665		27,117	1,145	28,262	40,512	36
Glass	9,800	8,661	1,138	5,770	6,167	70.3	6,089	378	6,467	3,332	3
Tinplate Steel (ferrous)	7,238	6,486	752	2,796	2,989	64.5	4,183	183	4,367	2,871	3
Aluminum (non-ferrous)	1,925	1,701	224	91	97	41.0	698	6	704	1,221	1
Plastic											
PET	403	356	47	282	301	83.4	297	18	316	88	0
HDPE	683	604	79	404	432	57.4	347	27	373	310	0
Other Plastic	10,113	8,939	1,175					0		10,113	9
Subtotal (Plastic)	11,200	9,899	1,301	686	733		644	45	689	10,511	9
Organics											
Food wastes	44,099	38,977	5,123	3,338	3,338		11,829	505	12,334	31,766	29
Yard waste	28,890	28,890	0	17,871	18,905		26,001	0	26,001	2,889	3
Subtotal (Organics)	72,989	67,867	5,123	21,209	22,243		37,830	505	38,335	34,655	31
Wood Waste	1,575	1,392	183		0		0	0	0	1,575	1
Construction/Demolition Waste	2,975	2,629	346		0		0	0	0	2,975	3
Disposable Diapers	5,250	4,640	610		0		0	0	0	5,250	5
Textiles/Leather/Rubber	8,050	7,115	935	61	61		55	6	61	7,988	7
Other	6,475	5,723	752	6,025	6,025		5,423	603	6,025	450	0
Subtotal (Wood - Other)	24,325	21,499	2,826	6,087	6,087		5,478	609	6,087	18,238	16
TOTAL	**196,250**	**176,898**	**19,352**	**54,100**	**56,981**		**82,038**	**2,872**	**84,910**	**111,340**	**100**

Residential Diversion = 43%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Markham, Richmond Hill and Region of York.
7) Number of backyard composters provided by York Region staff, 1993.
8) Households: S-F - 128,466; Semi/Town/Row - 14,495; Low Rise - 5,410; M-F - 13,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 7 for York Region specific assumptions.

Table K.4
Expanded Blue Box System
Region of York

Component	Residential Waste Generated (tonnes) All Households	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Existing Residential Diversion (tonnes)	Residential Diversion Existing/ Committed	Quinte Capture Rates (%)	Exp. BB Diversion S-F Hhlds (tonnes)	Exp. BB Diversion M-F Hhlds (tonnes)	Total Residential Diversion (tonnes)	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	196,250	176,898	19,352	54,100	56,981		82,471	3,983	86,454	109,796	
Paper											
Newspaper	32,899	29,078	3,822	16,641	17,788	82.4	23,960	1,575	25,535	7,365	7
Corrugated cardboard (OCC)	5,075	4,485	590	677	724	63.4	2,844	187	3,031	2,044	2
Telephone Directories	367	324	42	75	80	76.0	246	16	263	104	0
Mixed paper	30,433	26,897	3,535	69	73	13.8	3,712	244	3,956	26,477	24
Subtotal (Paper)	68,774	60,785	7,989	17,462	18,665		30,762	2,021	32,784	35,990	33
Glass	9,800	8,661	1,138	5,770	6,167	70.3	6,089	400	6,489	3,311	3
Tinplate Steel (ferrous)	7,238	6,486	752	2,796	2,989	64.5	4,183	243	4,426	2,812	3
Aluminum (non-ferrous)	1,925	1,701	224	91	97	41.0	698	46	743	1,182	1
Plastic											
PET	403	356	47	282	301	83.4	297	20	317	86	0
HDPE	683	604	79	404	432	57.4	347	23	369	314	0
Other Plastic	10,113	8,939	1,175			15.1	1,350	89	1,438	8,675	8
Subtotal (Plastic)	11,200	9,899	1,301	686	733		1,994	131	2,125	9,075	8
Organics											
Food wastes	44,099	38,977	5,123	3,338	3,338		10,515	505	11,019	33,080	30
Yard waste	28,890	28,890	0	17,871	18,905		22,282		22,282	6,608	6
Subtotal (Organics)	72,989	67,867	5,123	21,209	22,243		32,797	505	33,301	39,688	36
Wood Waste	1,575	1,392	183		0		0	0	0	1,575	1
Construction/Demolition Waste	2,975	2,629	346		0		0	0	0	2,975	3
Disposable Diapers	5,250	4,640	610		0		0	0	0	5,250	5
Textiles/Leather/Rubber	8,050	7,115	935	61	61	7.4	526	35	561	7,489	7
Other	6,475	5,723	752	6,025	6,025		5,423	603	6,025	450	0
Subtotal (Wood - Other)	24,325	21,499	2,826	6,087	6,087		5,949	637	6,586	17,738	16
TOTAL	**196,250**	**176,898**	**19,352**	**54,100**	**56,981**		**82,471**	**3,983**	**86,454**	**109,796**	**100**

Residential Diversion = 44%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Markham, Richmond Hill and Region of York.
7) Number of backyard composters provided by York Region staff, 1993.
8) Households: S-F - 128,466; Semi/Town/Row - 14,495; Low Rise - 5,410; M-F - 13,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 7 for York Region specific assumptions.

Table K.5
Wet/Dry System
Region of York

Component	Residential Waste Generated (tonnes) All Households	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Existing Residential Diversion (tonnes)	Residential Diversion Existing/ Committed	Quinte Capture Rates (%)	Wet/Dry Diversion S-F Hhlds (tonnes)	Wet/Dry Diversion M-F Hhlds (tonnes)	Total Residential Diversion (tonnes)	Residential Waste Landfilled (tonnes)	Disposed Waste Comp. %
Total Residential Waste (tonnes)	196,250	176,898	19,352	54,100	56,981		106,857	5,527	112,384	83,866	
Paper											
Newspaper	32,899	29,078	3,822	16,641	17,788	82.4	23,960	1,575	25,535	7,365	9
Corrugated cardboard (OCC)	5,075	4,485	590	677	724	63.4	2,844	187	3,031	2,044	2
Telephone Directories	367	324	42	75	80	76.0	246	16	263	104	0
Mixed paper	30,433	26,897	3,535	69	73	13.8	3,712	244	3,956	26,477	32
Subtotal (Paper)	68,774	60,785	7,989	17,462	18,665		30,762	2,021	32,784	35,990	43
Glass	9,800	8,661	1,138	5,770	6,167	70.3	6,089	400	6,489	3,311	4
Tinplate Steel (ferrous)	7,238	6,486	752	2,796	2,989	64.5	4,183	243	4,426	2,812	3
Aluminum (non-ferrous)	1,925	1,701	224	91	97	41.0	698	46	743	1,182	1
Plastic											
PET	403	356	47	282	301	83.4	297	20	317	86	0
HDPE	683	604	79	404	432	57.4	347	23	369	314	0
Other Plastic	10,113	8,939	1,175			15.1	1,350	89	1,438	8,675	10
Subtotal (Plastic)	11,200	9,899	1,301	686	733		1,994	131	2,125	9,075	11
Organics											
Food wastes	44,099	38,977	5,123	3,338	3,338		31,181	2,049	33,230	10,869	13
Yard waste	28,890	28,890	0	17,871	18,905		26,001		26,001	2,889	3
Subtotal (Organics)	72,989	67,867	5,123	21,209	22,243		57,182	2,049	59,231	13,758	16
Wood Waste	1,575	1,392	183		0		0	0		1,575	2
Construction/Demolition Waste	2,975	2,629	346		0		0	0		2,975	4
Disposable Diapers	5,250	4,640	610		0		0	0		5,250	6
Textiles/Leather/Rubber	8,050	7,115	935	61	61	7.4	526	35	561	7,489	9
Other	6,475	5,723	752	6,025	6,025		5,423	603	6,025	450	1
Subtotal (Wood - Other)	24,325	21,499	2,826	6,087	6,087		5,949	637	6,586	17,738	21
TOTAL	196,250	176,898	19,352	54,100	56,981		106,857	5,527	112,384	83,866	100

Residential Diversion = 57%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Markham, Richmond Hill and Region of York.
7) Number of backyard composters provided by York Region staff, 1993.
8) Households: S-F - 128,466; Semi/Town/Row - 14,495; Low Rise - 5,410; M-F - 13,283. Note that Semi/Town/Row included with S-F, Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 7 for York Region specific assumptions.

Table K.6
Mixed Solid Waste System
Region of York

Component	Residential Waste Gen. (tonnes) All Hhlds	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Res. Diversion (tonnes) Exist/Comm + B.Y. Compos.	Residential Waste Landfilled (tonnes)	Recovered for Recycling in MSW Processing	MSW plus E/C Diversion (tonnes)	Recovered for Composting in MSW Processing	MSW plus E/C plus Composting (landfilled)	MSW plus E/C plus Composting (marketed)	Residue Sent to Landfill from MSW Processing
Total Residential Waste (tonnes)	196,250	176,898	19,352	66,106	130,144						
Paper											
Newspaper	32,899	29,078	3,822	17,788	15,112	4,534	22,321	8,992	26,817	31,313	1,587
Corrugated cardboard (OCC)	5,075	4,485	590	724	4,351	2,175	2,900	1,849	3,824	4,749	326
Telephone Directories	367	324	42	80	287	143	223	122	284	345	21
Mixed paper	30,433	26,897	3,535	73	30,359	3,036	3,109	23,225	14,722	26,334	4,099
Subtotal (Paper)	68,774	60,785	7,989	18,665	50,108	9,888	28,554	34,187	45,647	62,741	6,033
Glass	9,800	8,661	1,138	6,167	3,633	727	6,894	0	6,894	6,894	2,906
Tinplate Steel (ferrous)	7,238	6,486	752	2,989	4,249	2,974	5,963	0	5,963	5,963	1,275
Aluminum (non-ferrous)	1,925	1,701	224	97	1,828	914	1,011	0	1,011	1,011	914
Plastic											
PET	403	356	47	301	102	102	403	0	403	403	0
HDPE	683	604	79	432	251	63	495	0	495	495	188
Other Plastic	10,113	8,939	1,175		10,113	0	0	0	0	0	10,113
Subtotal (Plastic)	11,200	9,899	1,301	733	10,467	165	898	0	898	898	10,302
Organics											
Food wastes	44,099	38,977	5,123	9,705	34,394	0	9,705	29,235	24,323	38,940	5,159
Yard waste	28,890	28,890	0	21,664	7,226	0	21,664	6,504	24,915	28,167	723
Subtotal (Organics)	72,989	67,867	5,123	31,369	41,621	0	31,369	35,739	49,238	67,107	5,882
Wood Waste	1,575	1,392	183	0	1,575	0	0	157	79	157	1,417
Construction/Demolition Waste	2,975	2,629	346	0	2,975	0	0	297	149	297	2,677
Disposable Diapers	5,250	4,640	610	0	5,250	0	0	0	0	0	5,250
Textiles/Leather/Rubber	8,050	7,115	935	61	7,988	799	860	0	860	860	7,190
Other	6,475	5,723	752	6,025	450	0	6,025	0	6,025	6,025	450
Subtotal (Wood - Other)	24,325	21,499	2,826	6,087	18,238	799	6,886	455	7,113	7,341	16,984
TOTAL	**196,250**	**176,898**	**19,352**	**66,106**	**130,144**	**15,467**	**81,573**	**70,381**	**116,764**	**151,954**	**44,296**
			Residential Diversion = 34%				**42%**		**59% (compost landfilled)**	**77% (compost marketed)**	

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Markham, Richmond Hill and Region of York.
7) Number of backyard composters provided by York Region staff, 1993.
8) Households: S-F - 128,466; Semi/Town/Row - 14,495; Low Rise - 5,410; M-F - 13,283. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 7 for York Region specific assumptions.

Table K.7

Estimated Residential Waste Generation, Diversion and Disposal Requirements For Six Residential Systems

Region of York

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Dir. Cost System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Exp. BB System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Wet/Dry System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Mixed Waste Proc. System Diversion (tonnes) (low)	(high)	Waste Requiring Disposal (tonnes) (low)	(tdhigh)
Residential System Diversion (%)					28%		29%		43%		44%		57%		59%	77%		
1996	609,230	225,415	1.4%	3,136	62,140	160,139	65,449	156,830	97,528	124,751	99,302	122,977	129,086	93,193	134,116	174,536	88,163	47,742
1997	632,532	234,037	1.7%	4,070	64,517	165,450	67,953	162,014	101,258	128,708	103,100	126,866	134,023	95,944	139,246	181,212	90,721	48,754
1998	656,725	242,988	2.1%	5,071	66,985	170,932	70,552	167,366	105,131	132,786	107,044	130,873	139,149	98,768	144,572	188,143	93,345	49,774
1999	681,844	252,282	2.4%	6,143	69,547	176,593	73,250	172,890	109,152	136,987	111,138	135,002	144,472	101,668	150,101	195,339	96,038	50,800
2000	707,923	261,932	2.8%	7,289	72,207	182,436	76,052	178,591	113,327	141,316	115,389	139,254	149,997	104,646	155,842	202,811	98,801	51,832
2001	735,000	271,950	3.1%	8,513	74,969	188,468	78,961	184,476	117,662	145,775	119,802	143,634	155,734	107,702	161,803	210,568	101,634	52,869
2002	752,824	278,545	3.5%	9,689	76,787	192,070	80,875	187,981	120,515	148,341	122,708	146,149	159,511	109,345	165,727	215,674	103,129	53,182
2003	771,080	285,300	3.8%	10,916	78,649	195,735	82,837	191,547	123,438	150,946	125,683	148,701	163,379	111,005	169,746	220,904	104,638	53,479
2004	789,778	292,218	4.2%	12,197	80,556	199,465	84,845	195,176	126,431	153,590	128,731	151,290	167,341	112,680	173,862	226,261	106,159	53,760
2005	808,931	299,304	4.5%	13,534	82,509	203,261	86,903	198,868	129,497	156,274	131,853	153,918	171,399	114,372	178,078	231,748	107,692	54,022
2006	828,547	306,562	4.9%	14,928	84,510	207,124	89,010	202,624	132,637	158,997	135,050	156,584	175,555	116,079	182,397	237,368	109,237	54,266
2007	848,639	313,996	5.2%	16,382	86,560	211,054	91,169	206,445	135,854	161,760	138,325	159,289	179,813	117,801	186,820	243,124	110,794	54,490
2008	869,219	321,611	5.6%	17,898	88,659	215,054	93,380	210,333	139,148	164,564	141,680	162,033	184,173	119,539	191,350	249,020	112,362	54,693
2009	890,297	329,410	5.9%	19,478	90,809	219,123	95,644	214,288	142,523	167,409	145,115	164,817	188,639	121,292	195,990	255,059	113,941	54,873
2010	911,887	337,398	6.3%	21,124	93,011	223,263	97,964	218,311	145,979	170,295	148,634	167,640	193,214	123,060	200,743	261,244	115,531	55,030
2011	934,000	345,580	6.6%	22,838	95,266	227,475	100,339	222,403	149,519	173,223	152,239	170,503	197,899	124,842	205,611	267,579	117,131	55,163
2012	949,405	351,280	7.0%	24,437	96,838	230,005	101,994	224,849	151,985	174,858	154,750	172,093	201,163	125,680	209,002	271,992	117,841	54,851
2013	965,064	357,074	7.3%	26,082	98,435	232,557	103,676	227,315	154,492	176,500	157,302	173,690	204,481	126,511	212,450	276,478	118,542	54,513
2014	980,981	362,963	7.7%	27,775	100,058	235,130	105,386	229,802	157,040	178,149	159,896	175,292	207,854	127,335	215,954	281,038	119,235	54,150
2015	997,161	368,950	8.0%	29,516	101,709	237,725	107,124	232,309	159,630	179,804	162,534	176,900	211,282	128,152	219,515	285,674	119,918	53,760
Total		6,038,795		301,016	1,664,718	4,073,061	1,753,363	3,984,416	2,612,746	3,125,033	2,660,274	3,077,505	3,458,165	2,279,614	3,592,926	4,675,774	2,144,853	1,062,006

Notes:

(1) Population data prepared by Hardy Stevenson and Associates, Mar. 21/94

(2) Population projection multiplied by 0.37 tonnes/capita/year (based on historical data)

SCHEDULE L

REGION OF PEEL ESTIMATES

Table L.1
Existing System
Region of Peel

Component	Residential Waste Generated (tonnes) - 1992 All Households	Residential Waste Generated S-F	Residential Waste Generated M-F	Residential Diversion (tonnes) - 1992 Std. Blue Box	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	313,296	238,153	75,143	59,967	253,329	
Paper						
Newspaper	53,909	39,147	14,763	21,534	32,375	13
Corrugated cardboard (OCC)	8,316	6,039	2,277	1,234	7,082	3
Telephone Directories	859	653	206	712	147	
Mixed paper	49,609	35,995	13,614	469	49,140	19
Subtotal (Paper)	112,694	81,833	30,860	23,949	88,745	35
Glass	16,058	11,661	4,397	6,674	9,384	4
Tinplate Steel (ferrous)	12,024	8,731	3,293			
Aluminum (non-ferrous)	3,154	2,290	864			
Subtotal (Alum. + Tin)	15,178	11,022	4,156	6,137	9,041	4
Plastic						
PET	661	480	181			
HDPE	1,119	813	307			
Other Plastic	16,572	12,034	4,538			
Subtotal (Plastic)	18,352	13,327	5,026	694	17,658	7
Organics						
Food wastes	72,262	52,473	19,788	6,532	65,730	
Yard waste	38,894	38,894	0	10,735	28,159	
Subtotal (Organics)	111,155	91,367	19,788	17,267	93,889	37
Wood Waste	2,581	1,874	707	2,490	91	
Construction/Demolition Waste	4,875	3,540	1,335	142	4,733	
Disposable Diapers	8,603	6,247	2,356		8,603	
Textiles/Leather/Rubber	13,191	9,578	3,612	390	12,801	
Other	10,610	7,704	2,905	2,224	8,386	
Subtotal (Wood - Other)	39,859	28,944	10,915	5,246	34,613	14
TOTAL	313,296	238,153	75,143	59,967	253,329	100

Residential Diversion = 19%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates for Existing System obtained from Region of Peel 1992 Annual Report.
7) Number of backyard composters provided by Region of Peel staff, 1993.
8) Households: S-F - 117,152; Semi/Town/Row - 54,783; Low Rise - 9,800; M-F - 55,039. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 8 for Region of Peel specific assumptions.

Table L.2
Existing/Committed System
Region of Peel

Component	Residential Waste Generated (tonnes) - 1992 All Households	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion (tonnes) - 1992 Std. Blue Box	Residential Diversion Existing/ Committed	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	313,296	238,153	75,143	59,967	78,457	234,839	
Paper							
Newspaper	53,909	39,147	14,763	21,534	21,986	31,923	14
Corrugated cardboard (OCC)	8,316	6,039	2,277	1,234	1,260	7,056	3
Telephone Directories	859	653	206	712	727	132	
Mixed paper	49,609	35,995	13,614	469	479	49,130	21
Subtotal (Paper)	112,694	81,833	30,860	23,949	24,452	88,242	38
Glass	16,058	11,661	4,397	6,674	6,814	9,244	4
Tinplate Steel (ferrous)	12,024	8,731	3,293				
Aluminum (non-ferrous)	3,154	2,290	864				
Subtotal Metals (commingled)	15,178	11,022	4,156	6,137	6,266	8,912	4
Plastic							
PET	661	480	181				
HDPE	1,119	813	307				
Other Plastic	16,572	12,034	4,538				
Subtotal (Plastic)	18,352	13,327	5,026	694	709	17,644	8
Organics							
Food wastes	72,262	52,473	19,788	6,532	7,911	64,351	
Yard waste	38,894	38,894	0	10,735	27,059	11,835	
Subtotal (Organics)	111,155	91,367	19,788	17,267	34,970	76,185	32
Wood Waste	2,581	1,874	707	2,490	2,490	91	
Construction/Demolition Waste	4,875	3,540	1,335	142	142	4,733	
Disposable Diapers	8,603	6,247	2,356			8,603	
Textiles/Leather/Rubber	13,191	9,578	3,612	390	390	12,801	
Other	10,610	7,704	2,905	2,224	2,224	8,386	
Subtotal (Wood - Other)	39,859	28,944	10,915	5,246	5,246	34,613	15
TOTAL	313,296	238,153	75,143	59,967	78,457	234,839	100

Residential Diversion = 25%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates for Existing System obtained from Region of Peel 1992 Annual Report.
7) Number of backyard composters provided by Region of Peel staff, 1993.
8) Households: S-F - 117,152; Semi/Town/Row - 54,783; Low Rise - 9,800; M-F - 55,039. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 8 for Region of Peel specific assumptions.

Table L.3
Direct Cost System
Region of Peel

Component	Res. Waste Generated (tonnes) All Hhlds	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion Existing/ Committed	Quinte Capture Rates (%)	Direct Cost Diversion S-F Hhlds (tonnes)	Direct Cost Diversion M-F Hhlds (tonnes)	Direct Cost Diversion All Hhlds (tonnes)	Res. Waste Landfilled (tonnes) 1992	Disposed Waste Comp. %
Total Residential Waste (tonnes)	313,296	238,153	75,143	78,457		106,955	8,201	115,156	198,140	
Paper										
Newspaper	53,909	39,147	14,763	21,986	82.40	32,257	3,488	35,745	18,165	9
Corrugated cardboard (OCC)	8,316	6,039	2,277	1,260	63.40	3,828	200	4,028	4,287	2
Telephone Directories	859	653	206	727	84.58	654	115	770	90	0
Mixed paper	49,609	35,995	13,614	479		431	48	479	49,130	25
Subtotal (Paper)	112,694	81,833	30,860	24,452		37,171	3,851	41,022	71,672	36
Glass	16,058	11,661	4,397	6,814	70.30	8,197	1,081	9,279	6,780	3
Tinplate Steel (ferrous)	12,024	8,731	3,293							
Aluminum (non-ferrous)	3,154	2,290	864							
Subtotal Metals (commingled)	15,178	11,022	4,156	6,266	61.40	6,767	994	7,761	7,417	4
Plastic										
PET	661	480	181		83.40	400	0	400	261	
HDPE	1,119	813	307		57.40	467	0	467	653	
Other Plastic	16,572	12,034	4,538					0	16,572	
Subtotal (Plastic)	18,352	13,327	5,026	709		867	0	867	17,485	9
Organics										
Food wastes	72,262	52,473	19,788	7,911		14,227	1,751	15,977	56,284	
Yard waste	38,894	38,894	0	27,059		35,004		35,004	3,889	
Subtotal (Organics)	111,155	91,367	19,788	34,970		49,231	1,751	50,982	60,174	30
Wood Waste	2,581	1,874	707	2,490		2,241	249	2,490	91	
Construction/Demolition Waste	4,875	3,540	1,335	142		128	14	142	4,733	
Disposable Diapers	8,603	6,247	2,356					0	8,603	
Textiles/Leather/Rubber	13,191	9,578	3,612	390		351	39	390	12,801	
Other	10,610	7,704	2,905	2,224		2,002	222	2,224	8,386	
Subtotal (Wood - Other)	39,859	28,944	10,915	5,246		4,721	525	5,246	34,613	17
TOTAL	**313,296**	**238,153**	**75,143**	**78,457**		**106,955**	**8,201**	**115,156**	**198,140**	**100**

Residential Diversion = 37%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates for Existing System obtained from Region of Peel 1992 Annual Report.
7) Number of backyard composters provided by Region of Peel staff, 1993.
8) Households: S-F - 117,152; Semi/Town/Row - 54,783; Low Rise - 9,800; M-F - 55,039. Note that Semi/Town/Row included with S-F, Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 8 for Region of Peel specific assumptions.

Table L.4
Expanded Blue Box System
Region of Peel

Component	Residential Waste Gen. (tonnes) All Hhlds	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion Existing/ Committed	Quinte Capture Rates (%)	Res. Div. (tonnes) Exp. BB S-F Hhlds	Res. Div. (tonnes) Exp. BB M-F Hhlds	Residential Diversion All Hhlds	Res. Waste Landfilled (tonnes) 1992	Disposed Waste Comp. %
Total Residential Waste (tonnes)	313,296	238,153	75,143	78,457		106,368	13,528	119,896	193,400	
Paper										
Newspaper	53,909	39,147	14,763	21,986	82.40	32,257	6,082	38,339	15,570	8
Corrugated cardboard (OCC)	8,316	6,039	2,277	1,260	63.40	3,828	722	4,550	3,765	2
Telephone Directories	859	653	206	727	84.58	654	87	741	118	
Mixed paper	49,609	35,995	13,614	479	13.80	4,967	939	5,907	43,702	23
Subtotal (Paper)	112,694	81,833	30,860	24,452		41,707	7,831	49,538	63,156	33
Glass	16,058	11,661	4,397	6,814	70.30	8,197	1,546	9,743	6,315	3
Tinplate Steel (ferrous)	12,024	8,731	3,293							
Aluminum (non-ferrous)	3,154	2,290	864							
Subtotal Metal(commingled)	15,178	11,022	4,156	6,266	61.40	6,767	1,276	8,043	7,135	4
Plastic										
PET	661	480	181		83.40	400	75	476	185	
HDPE	1,119	813	307		57.40	467	88	555	565	
Other Plastic	16,572	12,034	4,538		15.10	1,817	343	2,160	14,412	
Subtotal (Plastic)	18,352	13,327	5,026	709		2,684	506	3,190	15,162	8
Organics										
Food wastes	72,262	52,473	19,788	7,911		12,646	1,751	14,396	57,865	
Yard waste	38,894	38,894	0	27,059		29,287		29,287	9,607	
Subtotal (Organics)	111,155	91,367	19,788	34,970		41,933	1,751	43,684	67,472	35
Wood Waste	2,581	1,874	707	2,490		2,241	249	2,490	91	
Construction/Demolition Waste	4,875	3,540	1,335	142		128	14	142	4,733	
Disposable Diapers	8,603	6,247	2,356						8,603	
Textiles/Leather/Rubber	13,191	9,578	3,612	390	7.40	709	134	842	12,348	
Other	10,610	7,704	2,905	2,224		2,002	222	2,224	8,386	
Subtotal (Wood - Other)	39,859	28,944	10,915	5,246		5,079	619	5,698	34,160	18
TOTAL	313,296	238,153	75,143	78,457		106,368	13,528	119,896	193,400	100

Diversion = 38%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates for Existing System obtained from Region of Peel 1992 Annual Report.
7) Number of backyard composters provided by Region of Peel staff, 1993.
8) Households: S-F - 117,152; Semi/Town/Row - 54,783; Low Rise - 9,800; M-F - 55,039. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 8 for Region of Peel specific assumptions.

Table L.5
Wet/Dry System
Region of Peel

Component	Residential Waste Gen. (tonnes) All Hhlds	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Residential Diversion Existing/ Committed	Quinte Capture Rates (%)	Res. Div. (tonnes) Wet/Dry S-F Hhlds	Res. Div. (tonnes) Wet/Dry M-F Hhlds	Residential Diversion All Hhlds	Res. Waste Landfilled (tonnes) 1992	Disposed Waste Comp. %
Total Residential Waste (tonnes)	313,296	238,153	75,143	78,457		141,418	19,693	161,111	152,185	
Paper										
Newspaper	53,909	39,147	14,763	21,986	82.40	32,257	6,082	38,339	15,570	10
Corrugated cardboard (OCC)	8,316	6,039	2,277	1,260	63.40	3,828	722	4,550	3,765	2
Telephone Directories	859	653	206	727	84.58	654	87	741	118	
Mixed paper	49,609	35,995	13,614	479	13.80	4,967	939	5,907	43,702	29
Subtotal (Paper)	112,694	81,833	30,860	24,452		41,707	7,831	49,538	63,156	41
Glass	16,058	11,661	4,397	6,814	70.30	8,197	1,546	9,743	6,315	4
Tinplate Steel (ferrous)	12,024	8,731	3,293							
Aluminum (non-ferrous)	3,154	2,290	864							
Subtotal Metal(commingled)	15,178	11,022	4,156	6,266	61.40	6,767	1,276	8,043	7,135	5
Plastic										
PET	661	480	181		83.40	400	75	476	185	
HDPE	1,119	813	307		57.40	467	88	555	565	
Other Plastic	16,572	12,034	4,538		15.10	1,817	343	2,160	14,412	
Subtotal (Plastic)	18,352	13,327	5,026	709		2,684	506	3,190	15,162	10
Organics										
Food wastes	72,262	52,473	19,788	7,911		41,979	7,915	49,894	22,368	
Yard waste	38,894	38,894	0	27,059		35,004		35,004	3,889	
Subtotal (Organics)	111,155	91,367	19,788	34,970		76,983	7,915	84,898	26,257	17
Wood Waste	2,581	1,874	707	2,490		2,241	249	2,490	91	
Construction/Demolition Waste	4,875	3,540	1,335	142		128	14	142	4,733	
Disposable Diapers	8,603	6,247	2,356						8,603	
Textiles/Leather/Rubber	13,191	9,578	3,612	390	7.40	709	134	842	12,348	
Other	10,610	7,704	2,905	2,224		2,002	222	2,224	8,386	
Subtotal (Wood - Other)	39,859	28,944	10,915	5,246		5,079	619	5,698	34,160	22
TOTAL	313,296	238,153	75,143	78,457		141,418	19,693	161,111	152,185	100

Residential Diversion = 51%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates for Existing System obtained from Region of Peel 1992 Annual Report.
7) Number of backyard composters provided by Region of Peel staff, 1993.
8) Households: S-F - 117,152; Semi/Town/Row - 54,783; Low Rise - 9,800; M-F - 55,039. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 8 for Region of Peel specific assumptions.

Table L.6
Mixed Waste Processing System
Region of Peel

Component	Residential Waste Gen. (tonnes) All Hhlds	Residential Waste Generated S-F Hhlds	Residential Waste Generated M-F Hhlds	Res. Diversion (tonnes) Exist/Comm + B.Y. Compos.	Residential Waste Landfilled (tonnes)	Recovered for Recycling in MSW Processing	MSW plus E/C Diversion (tonnes)	Recovered for Composting in MSW Processing	MSW plus E/C plus Composting (landfilled)	MSW plus E/C plus Composting (marketed)	Residue ent to Landfil from MSW Processing
Total Residential Waste (tonnes)	313,296	238,153	75,143	84,846	228,450						
Paper											
Newspaper	53,909	39,147	14,763	21,986	31,923	9,577	31,563	18,994	41,060	50,557	3,352
Corrugated cardboard (OCC)	8,316	6,039	2,277	1,260	7,056	3,528	4,788	2,999	6,287	7,787	529
Telephone Directories	859	653	206	727	132	66	793	56	821	849	10
Mixed paper	49,609	35,995	13,614	479	49,130	4,913	5,392	37,585	24,184	42,976	6,633
Subtotal (Paper)	112,694	81,833	30,860	24,452	88,242	18,084	42,536	59,634	72,353	102,170	10,524
Glass	16,058	11,661	4,397	6,814	9,244	1,849	8,663	0	8,663	8,663	7,395
Tinplate Steel (ferrous)	12,024	8,731	3,293					0	0	0	0
Aluminum (non-ferrous)	3,154	2,290	864					0	0	0	0
Subtotal Metal (commingled)	15,178	11,022	4,156	6,266	8,912	5,868	12,134	0	12,134	12,134	3,044
Plastic											
PET	661	480	181							0	0
HDPE	1,119	813	307							0	0
Other Plastic	16,572	12,034	4,538							0	0
Subtotal (Plastic)	18,352	13,327	5,026	709	17,644	904	1,613	0	1,613	1,613	16,739
Organics											
Food wastes	72,262	52,473	19,788	12,816	59,446	0	12,816	50,529	38,080	63,345	8,917
Yard waste	38,894	38,894	0	28,543	10,350	0	28,543	9,315	33,201	37,859	1,035
Subtotal (Organics)	111,155	91,367	19,788	41,359	69,796	0	41,359	59,844	71,281	101,203	9,952
Wood Waste	2,581	1,874	707	2,490	91	0	2,490	9	2,495	2,499	82
Construction/Demolition Waste	4,875	3,540	1,335	142	4,733	0	142	473	379	615	4,260
Disposable Diapers	8,603	6,247	2,356		8,603	0	0	0	0	0	8,603
Textiles/Leather/Rubber	13,191	9,578	3,612	390	12,801	1,280	1,670	0	1,670	1,670	11,521
Other	10,610	7,704	2,905	2,224	8,386	0	2,224	0	2,224	2,224	8,386
Subtotal (Wood - Other)	39,859	28,944	10,915	5,246	34,613	1,280	6,526	482	6,767	7,008	32,850
TOTAL	313,296	238,153	75,143	84,846	228,450	27,985	112,831	119,961	172,811	232,792	80,504

Residential Diversion = 27% — **36%** (MSW plus E/C Diversion) — **55%** (compost landfilled) — **74%** (compost marketed)

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates for Existing System obtained from Region of Peel 1992 Annual Report.
7) Number of backyard composters provided by Region of Peel staff, 1993.
8) Households: S-F - 117,152; Semi/Town/Row - 54,783; Low Rise - 9,800; M-F - 55,039. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 8 for Region of Peel specific assumptions.

Table L.7

Estimated Residential Waste Generation, Diversion and Disposal For Six Residential Systems

Region of Peel

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Dir. Cost System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Exp. BB System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Wet/Dry System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Mixed Waste Proc. System Diversion (tonnes) (low)	(high)	Waste Requiring Disposal (tonnes) (low)	(high)
Residential System Diversion (%)					19%		25%		37%		38%		51%		55%	74%		
1996	851,745	349,215	1.4%	4,859	66,842	277,515	87,452	256,905	128,359	215,998	133,642	210,714	179,582	164,775	192,624	259,481	151,733	84,876
1997	877,758	359,881	1.7%	6,259	68,883	284,739	90,123	263,499	132,279	221,343	137,724	215,898	185,067	168,555	198,507	267,406	155,115	86,216
1998	904,565	370,872	2.1%	7,740	70,987	292,145	92,875	270,257	136,319	226,813	141,930	221,202	190,719	172,413	204,570	275,573	158,562	87,559
1999	932,191	382,198	2.4%	9,306	73,155	299,737	95,711	277,181	140,482	232,411	146,265	226,628	196,543	176,349	210,817	283,989	162,075	88,904
2000	960,661	393,871	2.8%	10,960	75,389	307,522	98,634	284,277	144,772	238,139	150,732	232,179	202,546	180,365	217,256	292,662	165,655	90,249
2001	990,000	405,900	3.1%	12,706	77,692	315,502	101,647	291,547	149,194	244,000	155,335	237,858	208,732	184,462	223,891	301,600	169,303	91,593
2002	1,004,943	412,027	3.5%	14,331	78,864	318,831	103,181	294,514	151,446	246,250	157,680	240,016	211,883	185,813	227,270	306,153	170,425	91,543
2003	1,020,112	418,246	3.8%	16,002	80,055	322,189	104,738	297,505	153,732	248,512	160,060	242,184	215,081	187,163	230,701	310,774	171,543	91,470
2004	1,035,510	424,559	4.2%	17,721	81,263	325,575	106,319	300,519	156,052	250,786	162,476	244,363	218,327	188,511	234,183	315,465	172,655	91,374
2005	1,051,140	430,967	4.5%	19,487	82,490	328,990	107,924	303,556	158,408	253,073	164,928	246,552	221,623	189,857	237,718	320,226	173,762	91,254
2006	1,067,005	437,472	4.9%	21,303	83,735	332,434	109,553	306,616	160,798	255,371	167,418	248,752	224,968	191,201	241,306	325,060	174,863	91,110
2007	1,083,111	444,076	5.2%	23,169	84,999	335,908	111,207	309,700	163,226	257,681	169,945	250,962	228,364	192,543	244,948	329,966	175,958	90,940
2008	1,099,459	450,778	5.6%	25,087	86,282	339,410	112,885	312,806	165,689	260,002	172,510	253,182	231,810	193,881	248,645	334,947	177,046	90,745
2009	1,116,055	457,583	5.9%	27,057	87,584	342,941	114,589	315,936	168,190	262,335	175,114	255,412	235,309	195,216	252,399	340,002	178,127	90,523
2010	1,132,900	464,489	6.3%	29,081	88,906	346,502	116,319	319,089	170,729	264,679	177,757	257,651	238,861	196,547	256,208	345,134	179,200	90,274
2011	1,150,000	471,500	6.6%	31,160	90,248	350,092	118,075	322,265	173,306	267,034	180,440	259,900	242,466	197,874	260,075	350,344	180,265	89,996
2012	1,160,554	475,827	7.0%	33,101	91,076	351,650	119,158	323,568	174,896	267,830	182,096	260,630	244,692	198,034	262,462	353,559	180,264	89,167
2013	1,171,204	480,194	7.3%	35,075	91,912	353,207	120,252	324,867	176,501	268,617	183,767	261,352	246,937	198,182	264,871	356,803	180,248	88,315
2014	1,181,952	484,600	7.7%	37,082	92,755	354,762	121,355	326,163	178,121	269,397	185,453	262,065	249,203	198,315	267,301	360,078	180,216	87,440
2015	1,192,798	489,047	8.0%	39,124	93,607	356,317	122,469	327,455	179,755	270,168	187,155	262,768	251,490	198,433	269,754	363,382	180,169	86,541
Total		8,603,302		420,610	1,646,725	6,535,966	2,154,467	6,028,225	3,162,252	5,020,439	3,292,424	4,890,267	4,424,203	3,758,488	4,745,508	6,392,603	3,437,184	1,790,088

Notes:

(1) Population data supplied by Hardy Stevenson and Associates, Mar. 21/94

(2) Population projection multiplied by 0.41 tonnes/capita/year (based on historical data)

SCHEDULE M

REGION OF HALTON ESTIMATES

Table M.1
Existing System
Region of Halton

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated (tonnes) S-F Hhlds	Residential Waste Generated (tonnes) M-F Hhlds	Residential Diversion (tonnes) 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	135,193	112,375	22,818	46,393	88,800	
Paper						
Newspaper	22,978	18,472	4,506	15,923	7,055	8
Corrugated cardboard (OCC)	3,544	2,849	695	2,177	1,367	2
Mixed paper	21,511	17,293	4,218		21,511	24
Subtotal (Paper)	48,034	38,614	9,420	18,100	29,934	34
Glass	6,844	5,502	1,342	4,944	1,900	2
Tinplate Steel (ferrous)	5,007	4,120	887			0
Aluminum (non-ferrous)	1,344	1,081	264			0
Plastic						
PET	282	226	55			
HDPE	477	384	94			
Other Plastic	7,063	5,678	1,385			
Subtotal (Tin, Alum,Plastic)	14,173	11,489	2,684	3,650	10,523	12
Organics						
Food wastes	30,800	24,760	6,040	2,953	27,847	
Yard waste	18,352	18,352	0	16,390	1,963	
Subtotal (Organics)	49,153	43,113	6,040	19,343	29,809	34
Wood Waste	1,100	884	216		1,100	
Construction/Demolition Waste	2,078	1,670	407	356	1,722	
Disposable Diapers	3,667	2,948	719		3,667	
Textiles/Leather/Rubber	5,622	4,520	1,103		5,622	
Other	4,522	3,635	887		4,522	
Subtotal (Wood - Other)	16,989	13,657	3,332	356	16,633	19
TOTAL	**135,193**	**112,375**	**22,818**	**46,393**	**88,800**	**100**

Residential Diversion = 34%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Region of Halton, 1993
7) Number of backyard composters provided by Region of Halton staff, 1993.
8) Households: S-F - 73,258; Semi/Town/Row - 16,536; Low Rise - 5,418; M-F - 16,374. Note that Semi/Town/Row included with S-F; Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 9 for Region of Halton specific assumptions.

Table M.2
Existing/Committed System
Region of Halton

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated (tonnes) S-F Hhlds	Residential Waste Generated (tonnes) M-F Hhlds	Residential Diversion (tonnes) 1992	Additional Diversion Existing/ Committed	Total Residential Diversion	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	135,193	112,375	22,818	46,393	5,895	52,288	82,905	
Paper								
Newspaper	22,978	18,472	4,506	15,923		15,923		0
Corrugated cardboard (OCC)	3,544	2,849	695	2,177		2,177		0
Mixed paper	21,511	17,293	4,218		4,515	4,515		0
Subtotal (Paper)	48,034	38,614	9,420	18,100	4,515	22,615	25,419	0
Glass	6,844	5,502	1,342	4,944	15	4,959	1,885	2
Tinplate Steel (ferrous)	5,007	4,120	887		15			0
Aluminum (non-ferrous)	1,344	1,081	264		305			0
Plastic								
PET	282	226	55					
HDPE	477	384	94		100			
Other Plastic	7,063	5,678	1,385		100			
Subtotal (Tin, Alum,Plastic)	14,173	11,489	2,684	3,650	520	4,170	10,003	12
Organics								
Food wastes	30,800	24,760	6,040	2,953	575	3,528		
Yard waste	18,352	18,352	0	16,390	270	16,660		
Subtotal (Organics)	49,153	43,113	6,040	19,343	845	20,188	28,964	35
Wood Waste	1,100	884	216			0	1,100	
Construction/Demolition Waste	2,078	1,670	407	356		356	1,722	
Disposable Diapers	3,667	2,948	719			0	3,667	
Textiles/Leather/Rubber	5,622	4,520	1,103			0	5,622	
Other	4,522	3,635	887			0	4,522	
Subtotal (Wood - Other)	16,989	13,657	3,332	356	0	356	16,633	20
TOTAL	**135,193**	**112,375**	**22,818**	**46,393**	**5,895**	**52,288**	**82,905**	**69**

Residential Diversion = 39%

Notes:

1) Composition estimates based on East York data from "Residential Waste Composition Study, Vol. I of the Ontario Waste Comp. Study", Gore & Storrie Ltd., Jan/91 (excl. yard waste).
2) Yard Waste (comp. generated) data from "The Physical and Economic Dimensions of Municipal Solid Waste in Ontario", CH2MHill Eng. Ltd., Nov/91
3) White Goods (comp. generated) estimate (included in Tinplate Steel total) from "Residential Waste Comp. Study, Vol. I of the Ontario Waste Comp. Study", G & S Ltd., 1990
4) Relative plastics composition based on Beck et al, 1992
5) Household data provided by Hardy Stevenson & Associates, 1994
6) Diversion estimates provided by Region of Halton, 1993
7) Number of backyard composters provided by Region of Halton staff, 1993.
8) Households: S-F - 73,258; Semi/Town/Row - 16,536; Low Rise - 5,418; M-F - 16,374. Note that Semi/Town/Row included with S-F, Low Rise included with M-F for this analysis.
9) Refer to Chapter 4 for general assumptions; Chapter 9 for Region of Halton specific assumptions.

SCHEDULE N

IC&I WASTE ESTIMATE TABLES

SCHEDULE N — IC&I WASTE ESTIMATE TABLES

Tables N-1 through N-6 present the estimated generation rates and the waste composition by major SIC group (excluding C&D), and the quantities of waste potentially subject to the 3Rs Regulations and NAPP (if generators of all sizes were subject to the regulations), for each GTA Region and for the entire GTA. These were used to estimate the potential diversion under the Existing/Committed System.

Tables N-7 through N-12 are similar tables for the Extended 3Rs Regulations and NAPP, which were used to estimate potential diversion under the Extended 3Rs System.

Tables N-13 and N-14 are similar tables for the entire GTA only, for the Expanded 3Rs Regulations and the Expanded 3Rs Regulations with Organics respectively, which were used to estimate potential diversion under System 4 and System 5.

Tables N-15 through N-26 present projections of waste generated, waste diverted through source reduction, reuse and recycling and waste requiring disposal in landfills over the planning period from 1996 to 2015.

TABLE N-1
Estimated Potential Diversion
Existing/Committed
for Major SIC Groups for Region of Durham
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition													
			1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-ferr	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.39	23.4%	0.0%	10.1%	0.0%	11.9%	5.3%	0.0%	0.0%	2.2%	0.0%	0.0%	31.8%	15.2%	100.0%
	Generated (tonnes)		402	0	174	0	204	92	0	0	38	0	0	547	261	1,719
	Potential Diversion (tonnes)		201	0	23	0	51	31	0	0					52	358
2 Manufacturing	Composition Generated (%)	1.56	11.6%	3.2%	19.2%	2.1%	13.1%	6.3%	0.1%	0.0%	8.8%	2.0%	0.8%	18.3%	14.5%	100.0%
	Generated (tonnes)		7,252	2,032	12,002	1,299	8,185	3,914	63	9	5,508	1,265	531	11,468	9,063	62,590
	Potential Diversion (tonnes)		7,252	2,032	6,546	1,299	8,185	3,914	63	9	2,754			11,468	1,813	45,334
4 Transportation/ Communication/ Utilities	Composition Generated (%)	0.56	13.0%	3.9%	28.5%	2.3%	11.2%	7.8%	0.8%	0.3%	12.3%	1.9%	0.2%	4.5%	13.2%	100.0%
	Generated (tonnes)		1,175	356	2,570	205	1,012	699	74	23	1,110	168	19	406	1,191	9,008
	Potential Diversion (tonnes)		588	178	657	97	379	292	46	15	139			101	238	2,730
5 Trade: Wholesale	Composition Generated (%)	1.22	27.0%	1.0%	11.5%	0.8%	4.0%	2.5%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	8.7%	100.0%
	Generated (tonnes)		1,747	65	744	52	259	159	0	0	1,081	324	52	1,424	566	6,472
	Potential Diversion (tonnes)		874		335	23	116	72	0	0	486			712	113	2,731
6 Trade: Retail	Composition Generated (%)	1.09	24.7%	11.3%	27.9%	3.7%	2.9%	0.4%	5.9%	0.1%	4.8%	11.8%	0.7%	1.4%	4.4%	100.0%
	Generated (tonnes)		6,285	2,879	7,107	955	743	93	1,513	20	1,228	2,996	186	357	1,119	25,481
	Potential Diversion (tonnes)		6,285	2,879	290	859	297	62	757	10					224	11,663
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.19	9.7%	2.1%	50.1%	3.1%	2.8%	1.9%	1.1%	0.5%	7.5%	7.7%	0.8%	2.3%	10.3%	100.0%
	Generated (tonnes)		139	30	718	45	40	27	16	8	108	110	12	33	148	1,431
	Potential Diversion (tonnes)		139	30	603	40	20	18	8	4					30	891
8 Services: Non-Commercial	Composition Generated (%)	0.75	6.6%	4.8%	30.0%	1.8%	11.2%	11.5%	0.2%	0.1%	10.1%	10.0%	6.7%	1.0%	6.0%	100.0%
	Generated (tonnes)		1,220	888	5,546	326	2,070	2,130	37	19	1,874	1,849	1,238	185	1,105	18,488
	Potential Diversion (tonnes)		1,220	888	277	293	994	1,053	19	9					221	4,974
9 Services: Commercial	Composition Generated (%)	0.86	13.5%	2.5%	25.2%	10.6%	5.4%	2.7%	2.6%	0.7%	5.3%	25.9%	0.8%	1.7%	3.1%	100.0%
	Generated (tonnes)		2,970	543	5,547	2,339	1,194	602	573	150	1,160	5,715	185	373	682	22,034
	Potential Diversion (tonnes)		2,970	543	1,451	2,105	119	482	286	75					136	8,168
10 Public Administration	Composition Generated (%)	0.23	10.0%	0.0%	38.0%	5.0%	3.0%	1.7%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.3%	100.0%
	Generated (tonnes)		222	0	844	111	67	37	0	0	155	44	0	0	740	2,220
	Potential Diversion (tonnes)		222	0	219	100	33	25	0	0					148	748
Total IC&I Waste Stream	Composition (% total)		14%	5%	24%	4%	9%	5%	2%	0%	8%	8%	1%	10%	10%	100%
	Generated (tonnes)		21,413	6,792	35,252	5,331	13,774	7,752	2,276	229	12,262	12,470	2,223	14,792	14,876	149,443
-	Potential Diversion (tonnes)		19,751	6,549	10,401	4,818	10,196	5,948	1,179	122	3,379	0	0	12,281	2,975	77,598

TABLE N-2
Estimated Potential Diversion
Existing/Committed
for Major SIC Groups for Metropolitan Toronto
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Fern	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.83	13.9%	0.0%	8.8%	0.0%	16.8%	10.0%	0.0%	0.0%	2.2%	0.0%	0.0%	27.4%	20.9%	100.0%
	Generated (tonnes)		810	0	512	0	980	585	0	0	130	0	0	1,596	1,219	5,831
	Potential Diversion (tonnes)		405	0	67	0	245	196	0	0					244	1,156
2 Manufacturing	Composition Generated (%)	1.70	14.3%	2.9%	22.2%	1.9%	9.9%	5.2%	0.3%	0.1%	9.1%	5.1%	0.6%	14.9%	13.5%	100.0%
	Generated (tonnes)		50,245	10,061	78,093	6,555	34,934	18,295	1,083	206	31,988	17,919	2,166	52,539	47,456	351,541
	Potential Diversion (tonnes)		50,245	10,061	66,169	6,555	34,934	18,295	1,083	206	15,994			52,539	9,491	265,574
4 Transportation/ Communication/ Utilities	Composition Generated (%)	0.74	13.2%	5.3%	27.8%	3.0%	13.1%	9.6%	1.3%	0,3%	11.6%	3.0%	0.3%	3.6%	8.0%	100.0%
	Generated (tonnes)		10,128	4,041	21,300	2,314	10,052	7,311	975	254	8,842	2,292	203	2,749	6,089	76,548
	Potential Diversion (tonnes)		5,064	2,020	5,445	1,099	3,769	3,052	609	158	1,105			687	1,218	24,227
5 Trade: Wholesale	Composition Generated (%)	1.40	27.0%	1.0%	11.5%	0.8%	3.5%	2.0%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.6%	100.0%
	Generated (tonnes)		22,150	820	9,434	656	2,896	1,678	0	0	13,700	4,102	656	18,048	7,895	82,038
	Potential Diversion (tonnes)		11,075		4,245	295	1,303	755	0	0	6,165			9,024	1,579	34,443
6 Trade: Retail	Composition Generated (%)	1.29	24.7%	11.4%	28.6%	3.7%	2.5%	0.4%	5.7%	0.1%	5.0%	12.1%	0.7%	1.4%	3.7%	100.0%
	Generated (tonnes)		51,172	23,647	59,223	7,705	5,279	727	11,856	206	10,343	25,110	1,535	2,894	7,645	207,343
	Potential Diversion (tonnes)		51,172	23,647	2,416	6,935	2,112	487	5,928	103					1,529	94,330
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.23	9.2%	2.0%	52.0%	3.5%	2.5%	2.2%	1.4%	0.7%	8.1%	7.7%	0.6%	1.6%	8.5%	100.0%
	Generated (tonnes)		3,372	740	18,956	1,273	919	789	502	248	2,952	2,818	211	584	3,118	36,482
	Potential Diversion (tonnes)		3,372	740	15,923	1,146	460	528	251	124					624	23,167
8 Services: Non-Commercial	Composition Generated (%)	0.91	6.6%	4.7%	30.0%	1.7%	11.3%	11.5%	0.2%	0.1%	10.2%	10.0%	6.7%	0.9%	6.1%	100.0%
	Generated (tonnes)		12,462	9,019	56,977	3,238	21,369	21,901	355	178	19,351	18,992	12,810	1,777	11,494	189,922
	Potential Diversion (tonnes)		12,462	9,019	2,849	2,914	10,286	10,835	178	89					2,299	50,930
9 Services: Commercial	Composition Generated (%)	0.89	11.8%	3.3%	29.1%	9.1%	6.8%	4.0%	2.8%	0.7%	6.0%	20.8%	0.7%	1.4%	3.3%	100.0%
	Generated (tonnes)		32,893	9,269	81,092	25,468	19,041	11,099	7,808	2,011	16,668	58,006	2,017	3,895	9,267	278,534
	Potential Diversion (tonnes)		32,893	9,269	29,553	22,922	1,904	8,879	3,904	1,005					1,853	112,182
10 Public Administration	Composition Generated (%)	0.29	10.0%	0.0%	38.0%	5.0%	3.0%	1.6%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.4%	100.0%
	Generated (tonnes)		2,738	0	10,405	1,369	821	428	0	0	1,917	548	0	0	9,155	27,382
	Potential Diversion (tonnes)		2,738	0	2,705	1,232	411	287	0	0					1,831	9,205
Total IC&I Waste Stream	Composition (% total)		14.8%	4.6%	26.8%	3.9%	7.7%	5.0%	1.8%	0.2%	8.4%	10.3%	1.6%	6.7%	8.2%	100.0%
	Generated (tonnes)		185,970	57,597	335,992	48,579	96,292	62,812	22,579	3,102	105,890	129,788	19,598	84,082	103,339	1,258,620
	Potential Diversion (tonnes)		169,426	54,756	129,373	43,098	55,424	43,315	11,953	1,685	23,264	0	0	62,250	20,668	615,213

TABLE N-3
Estimated Potential Diversion
Existing/Committed
for Major SIC Groups for York Region
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.55	22.7%	0.0%	10.5%	0.0%	11.3%	4.2%	0.0%	0.0%	2.1%	0.0%	0.0%	34.8%	14.5%	100.0%
	Generated (tonnes)		679	0	314	0	338	125	0	0	61	0	0	1,040	434	2,990
	Potential Diversion (tonnes)		339	0	41	0	85	42	0	0					87	593
2 Manufacturing	Composition Generated (%)	1.93	12.6%	2.8%	20.8%	1.8%	12.8%	6.7%	0.2%	0.0%	8.3%	2.8%	0.6%	18.8%	11.8%	100.0%
	Generated (tonnes)		12,575	2,837	20,694	1,795	12,730	6,657	182	25	8,296	2,772	587	18,773	11,795	99,717
	Potential Diversion (tonnes)		12,575	2,837	17,429	1,795	12,730	6,657	182	25	4,148			18,773	2,359	79,509
4 Transportation/ Communication/ Utilities	Composition Generated (%)	1.07	14.1%	5.7%	24.0%	3.3%	14.9%	11.2%	1.0%	0.4%	12.4%	2.0%	0.3%	3.6%	7.0%	100.0%
	Generated (tonnes)		2,064	830	3,522	483	2,191	1,640	140	57	1,822	299	46	533	1,033	14,662
	Potential Diversion (tonnes)		1,032	415	900	230	822	685	88	36	228			133	207	4,775
5 Trade: Wholesale	Composition Generated (%)	1.71	27.0%	1.0%	11.5%	0.8%	3.8%	2.3%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.2%	100.0%
	Generated (tonnes)		9,254	343	3,941	274	1,289	772	0	0	5,724	1,714	274	7,540	3,149	34,273
	Potential Diversion (tonnes)		4,627		1,774	123	580	347	0	0	2,576			3,770	630	14,426
6 Trade: Retail	Composition Generated (%)	1.58	23.5%	11.0%	29.0%	3.5%	3.0%	0.3%	6.2%	0.1%	5.1%	11.6%	0.8%	1.4%	4.5%	100.0%
	Generated (tonnes)		13,409	6,290	16,528	1,971	1,691	189	3,560	60	2,916	6,629	445	812	2,582	57,082
	Potential Diversion (tonnes)		13,409	6,290	643	1,774	676	126	1,780	30					516	25,245
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.26	9.7%	2.1%	49.8%	3.1%	3.0%	2.4%	1.1%	0.5%	7.3%	7.7%	0.9%	2.4%	9.9%	100.0%
	Generated (tonnes)		440	95	2,252	140	136	106	51	24	330	349	39	107	449	4,518
	Potential Diversion (tonnes)		440	95	1,891	126	68	71	26	12					90	2,819
8 Services: Non-Commercial	Composition Generated (%)	1.00	6.7%	5.0%	30.0%	1.9%	11.0%	11.5%	0.2%	0.1%	10.0%	10.0%	6.6%	1.2%	5.8%	100.0%
	Generated (tonnes)		1,861	1,373	8,310	535	3,059	3,181	66	33	2,767	2,770	1,818	332	1,595	27,700
	Potential Diversion (tonnes)		1,861	1,373	415	481	1,455	1,569	33	17					319	7,524
9 Services: Commercial	Composition Generated (%)	1.09	11.6%	3.0%	29.8%	8.6%	6.9%	4.4%	2.8%	0.7%	6.1%	20.1%	0.8%	1.7%	3.4%	100.0%
	Generated (tonnes)		6,849	1,773	17,679	5,121	4,092	2,581	1,631	431	3,617	11,930	475	1,025	2,034	59,238
	Potential Diversion (tonnes)		6,849	1,773	6,162	4,609	409	2,064	816	215					407	23,304
10 Public Administration	Composition Generated (%)	0.31	10.0%	0.0%	38.0%	5.0%	3.0%	1.9%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.1%	100.0%
	Generated (tonnes)		249	0	945	124	75	46	0	0	174	50	0	0	824	2,486
	Potential Diversion (tonnes)		249	0	246	112	37	31	0	0					165	839
Total IC&I Waste Stream	Composition (% total)		26%	8%	19%	6%	11%	7%	2%	0%	4%	0%	0%	14%	3%	100%
	Generated (tonnes)		47,379	13,541	74,184	10,443	25,600	15,296	5,631	629	25,708	26,513	3,683	30,161	23,894	302,665
	Potential Diversion (tonnes)		41,381	12,783	29,502	9,249	16,862	11,593	2,924	334	6,951	0	0	22,676	4,779	159,034

TABLE N-4
Estimated Potential Diversion
Existing/Committed
for Major SIC Groups for Peel Region
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.62	18.0%	0.0%	9.8%	0.0%	13.1%	7.9%	0.0%	0.0%	3.6%	0.0%	0.0%	29.7%	17.8%	100.0%
	Generated (tonnes)		446	0	243	0	325	197	0	0	90	0	0	737	440	2,477
	Potential Diversion (tonnes)		223	0	32	0	81	66	0	0					88	490
2 Manufacturing	Composition Generated (%)	1.78	15.1%	2.9%	18.5%	2.0%	12.9%	6.4%	0.2%	0.1%	9.7%	5.9%	0.6%	15.0%	10.7%	100.0%
	Generated (tonnes)		25,544	4,968	31,236	3,356	21,810	10,858	401	128	16,452	9,940	1,067	25,347	18,095	169,203
	Potential Diversion (tonnes)		25,544	4,968	25,435	3,356	21,810	10,858	401	128	8,226			25,347	3,619	129,693
4 Transportation/ Communication/ Utilities	Composition Generated (%)	1.09	13.6%	5.4%	28.7%	3.2%	14.8%	11.1%	1.0%	0.4%	10.9%	2.1%	0.3%	3.6%	4.9%	100.0%
	Generated (tonnes)		6,726	2,690	14,202	1,563	7,301	5,467	482	184	5,404	1,046	147	1,793	2,396	49,401
	Potential Diversion (tonnes)		3,363	1,345	3,630	742	2,738	2,283	301	115	675			448	479	16,120
5 Trade: Wholesale	Composition Generated (%)	1.57	27.0%	1.0%	11.5%	0.8%	3.8%	2.3%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.2%	100.0%
	Generated (tonnes)		13,036	483	5,552	386	1,816	1,089	0	0	8,063	2,414	386	10,622	4,433	48,280
	Potential Diversion (tonnes)		6,518		2,499	174	817	490	0	0	3,628			5,311	887	20,323
6 Trade: Retail	Composition Generated (%)	1.11	24.8%	11.6%	27.4%	3.8%	3.1%	0.4%	6.1%	0.1%	4.3%	11.3%	0.7%	1.5%	4.9%	100.0%
	Generated (tonnes)		4,466	2,087	4,934	686	557	68	1,096	19	773	2,036	123	277	886	18,010
	Potential Diversion (tonnes)		4,466	2,087	199	617	223	46	548	10					177	8,373
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.25	9.9%	2.0%	49.4%	3.0%	3.2%	2.8%	1.0%	0.5%	7.5%	7.5%	0.9%	2.5%	9.8%	100.0%
	Generated (tonnes)		467	96	2,325	141	149	130	48	24	352	355	42	116	461	4,707
	Potential Diversion (tonnes)		467	96	1,953	127	74	87	24	12					92	2,933
8 Services: Non-Commercial	Composition Generated (%)	0.90	6.8%	5.0%	30.0%	2.0%	11.0%	11.5%	0.3%	0.1%	9.9%	10.0%	6.5%	1.3%	5.7%	100.0%
	Generated (tonnes)		2,387	1,769	10,604	699	3,887	4,056	89	44	3,516	3,535	2,305	443	2,013	35,348
	Potential Diversion (tonnes)		2,387	1,769	530	629	1,844	1,999	44	22					403	9,628
9 Services: Commercial	Composition Generated (%)	1.06	11.9%	3.9%	28.8%	9.5%	6.7%	4.2%	2.9%	0.7%	5.9%	21.1%	0.6%	0.9%	2.8%	100.0%
	Generated (tonnes)		8,645	2,828	20,904	6,875	4,889	3,052	2,118	528	4,323	15,332	448	660	2,061	72,662
	Potential Diversion (tonnes)		8,645	2,828	7,199	6,188	489	2,441	1,059	264					412	29,525
10 Public Administration	Composition Generated (%)	0.34	10.0%	0.0%	38.0%	5.0%	3.0%	1.4%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.6%	100.0%
	Generated (tonnes)		553	0	2,101	276	166	76	0	0	387	111	0	0	1,859	5,528
	Potential Diversion (tonnes)		553	0	546	249	83	51	0	0					372	1,853
Total IC&I Waste Stream	Composition (% total)		15.4%	3.7%	22.7%	3.4%	10.1%	6.2%	1.0%	0.2%	9.7%	8.6%	1.1%	9.9%	8.0%	100.0%
	Generated (tonnes)		62,270	14,921	92,101	13,983	40,900	24,992	4,234	927	39,360	34,769	4,518	39,995	32,645	405,616
	Potential Diversion (tonnes)		52,166	13,093	42,023	12,082	28,160	18,321	2,378	551	12,530	0	0	31,106	6,529	218,938

TABLE N-5
Estimated Potential Diversion
Existing/Committed
for Major SIC Groups for Halton Region
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.33	20.0%	0.0%	9.1%	0.0%	14.5%	6.9%	0.0%	0.0%	1.2%	0.0%	0.0%	31.9%	16.5%	100.0%
	Generated (tonnes)		223	0	102	0	163	77	0	0	14	0	0	357	184	1,120
	Potential Diversion (tonnes)		112	0	13	0	41	26	0	0					37	228
2 Manufacturing	Composition Generated (%)	0.98	13.0%	3.3%	16.5%	2.2%	15.7%	7.4%	0.2%	0.0%	8.7%	3.4%	0.8%	16.4%	12.4%	100.0%
	Generated (tonnes)		4,131	1,038	5,251	708	4,980	2,360	50	10	2,758	1,074	249	5,202	3,922	31,735
	Potential Diversion (tonnes)		4,131	1,038	4,126	708	4,980	2,360	50	10	1,379			5,202	784	24,769
4 Transportation/ Communication/ Utilities	Composition Generated (%)	0.53	13.8%	5.2%	26.7%	3.0%	14.3%	10.6%	0.8%	0.4%	11.9%	1.7%	0.3%	3.9%	7.4%	100.0%
	Generated (tonnes)		482	180	933	105	499	370	28	13	415	61	10	137	260	3,492
	Potential Diversion (tonnes)		241	90	69	50	187	154	18	8	52			34	52	955
5 Trade: Wholesale	Composition Generated (%)	0.82	27.0%	1.0%	11.5%	0.8%	3.8%	2.3%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.1%	100.0%
	Generated (tonnes)		1,789	66	762	53	255	153	0	0	1,106	331	53	1,457	600	6,625
	Potential Diversion (tonnes)		894		343	24	115	69	0	0	498			729	120	2,791
6 Trade: Retail	Composition Generated (%)	0.76	24.4%	11.6%	28.0%	3.8%	2.9%	0.4%	6.1%	0.1%	4.6%	11.8%	0.7%	1.4%	4.3%	100.0%
	Generated (tonnes)		4,127	1,960	4,743	639	494	60	1,027	14	786	2,003	124	229	728	16,936
	Potential Diversion (tonnes)		4,127	1,960	193	575	198	41	513	7					146	7,759
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.12	9.7%	2.0%	50.3%	3.2%	2.8%	2.2%	1.1%	0.6%	7.8%	7.6%	0.8%	2.1%	9.8%	100.0%
	Generated (tonnes)		107	22	555	35	31	24	13	6	86	84	8	24	108	1,103
	Potential Diversion (tonnes)		107	22	466	31	16	16	6	3					22	690
8 Services: Non-Commercial	Composition Generated (%)	0.49	6.7%	4.9%	30.0%	1.9%	11.1%	11.5%	0.2%	0.1%	10.0%	10.0%	6.6%	1.2%	5.8%	100.0%
	Generated (tonnes)		635	468	2,846	180	1,050	1,090	22	11	950	949	625	110	550	9,486
	Potential Diversion (tonnes)		635	468	142	162	500	538	11	6					110	2,572
9 Services: Commercial	Composition Generated (%)	0.58	12.8%	2.8%	26.5%	10.0%	5.8%	3.2%	2.7%	0.7%	5.5%	24.0%	0.9%	1.8%	3.3%	100.0%
	Generated (tonnes)		2,078	451	4,302	1,620	944	524	440	111	885	3,890	140	291	538	16,214
	Potential Diversion (tonnes)		2,078	451	1,223	1,458	94	419	220	56					108	6,107
10 Public Administration	Composition Generated (%)	0.17	10.0%	0.0%	38.0%	5.0%	3.0%	1.6%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.4%	100.0%
	Generated (tonnes)		116	0	440	58	35	18	0	0	81	23	0	0	387	1,158
	Potential Diversion (tonnes)		116	0	114	52	17	12	0	0					77	389
Total IC&I Waste Stream	Composition (% total)		27%	9%	14%	7%	13%	8%	2%	0%	4%	0%	0%	13%	3%	100%
	Generated (tonnes)		13,689	4,185	19,934	3,399	8,451	4,675	1,580	166	7,081	8,415	1,210	7,807	7,276	87,868
	Potential Diversion (tonnes)		12,442	4,029	6,689	3,061	6,148	3,634	819	90	1,929	0	0	5,965	1,455	46,261

TABLE N-6
Estimated Potential Diversion
Under Existing/Committed System
for Major SIC Groups for GTA
1992

Major IC&I Group		1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-ferr	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
		Waste Composition													
1 Primary	Composition Generated (%)	18.11%	0.00%	9.51%	0.00%	14.22%	7.60%	0.00%	0.00%	2.36%	0.00%	0.00%	30.25%	17.96%	100.0%
	Generated (tonnes)	2,560	0	1,344	0	2,010	1,074	0	0	333	0	0	4,276	2,539	14,136
	Potential Diversion (tonnes)	1,280	0	175	0	502	360	0	0	0	0	0	0	508	2,825
2 Manufacturing	Composition Generated (%)	13.95%	2.93%	20.60%	1.92%	11.56%	5.89%	0.25%	0.05%	9.09%	4.61%	0.64%	15.85%	12.64%	100.0%
	Generated (tonnes)	99,747	20,936	147,276	13,714	82,640	42,084	1,780	378	65,001	32,970	4,600	113,328	90,331	714,786
	Potential Diversion (tonnes)	99,747	20,936	119,705	13,714	82,640	42,084	1,780	378	32,501	0	0	113,328	18,066	544,879
4 Transportation/ Communication/ Utilities	Composition Generated (%)	13.44%	5.29%	27.78%	3.05%	13.75%	10.11%	1.11%	0.35%	11.49%	2.52%	0.28%	3.67%	7.16%	100.0%
	Generated (tonnes)	20,576	8,097	42,527	4,670	21,055	15,486	1,699	531	17,593	3,866	424	5,618	10,969	153,110
	Potential Diversion (tonnes)	10,288	4,048	10,701	2,218	7,896	6,465	1,062	332	2,199	0	0	1,404	2,194	48,808
5 Trade: Wholesale	Composition Generated (%)	27.00%	1.00%	11.50%	0.80%	3.67%	2.17%	0.00%	0.00%	16.70%	5.00%	0.80%	22.00%	9.37%	100.0%
	Generated (tonnes)	47,976	1,777	20,434	1,422	6,515	3,851	0	0	29,674	8,884	1,422	39,091	16,643	177,688
	Potential Diversion (tonnes)	23,988	0	9,195	640	2,932	1,733	0	0	13,353	0	0	19,546	3,329	74,715
6 Trade: Retail	Composition Generated (%)	24.46%	11.35%	28.49%	3.68%	2.70%	0.35%	5.86%	0.10%	4.94%	11.94%	0.74%	1.41%	3.99%	100.0%
	Generated (tonnes)	79,459	36,864	92,535	11,956	8,764	1,137	19,052	320	16,046	38,775	2,414	4,569	12,960	324,851
	Potential Diversion (tonnes)	79,459	36,864	3,742	10,761	3,506	762	9,526	160	0	0	0	0	2,592	147,371
7 Financial, Insurance & Real Estate	Composition Generated (%)	9.38%	2.04%	51.42%	3.39%	2.64%	2.23%	1.31%	0.64%	7.94%	7.70%	0.65%	1.79%	8.88%	100.0%
	Generated (tonnes)	4,525	982	24,806	1,633	1,276	1,076	630	310	3,828	3,716	312	863	4,284	48,241
	Potential Diversion (tonnes)	4,525	982	20,837	1,470	638	721	315	155	0	0	0	0	857	30,500
8 Services: Non-Commercial	Composition Generated (%)	6.61%	4.81%	30.00%	1.77%	11.19%	11.52%	0.20%	0.10%	10.13%	10.00%	6.69%	1.01%	5.96%	100.0%
	Generated (tonnes)	18,565	13,516	84,283	4,978	31,435	32,358	570	285	28,458	28,094	18,796	2,848	16,757	280,943
	Potential Diversion (tonnes)	18,565	13,516	4,214	4,480	15,080	15,994	285	142	0	0	0	0	3,351	75,628
9 Services: Commercial	Composition Generated (%)	11.91%	3.31%	28.87%	9.23%	6.72%	3.98%	2.80%	0.72%	5.94%	21.14%	0.73%	1.39%	3.25%	100.0%
	Generated (tonnes)	53,435	14,865	129,524	41,424	30,161	17,856	12,570	3,231	26,653	94,873	3,265	6,244	14,582	448,683
	Potential Diversion (tonnes)	53,435	14,865	45,588	37,281	3,016	14,285	6,285	1,615	0	0	0	0	2,916	179,286
10 Public Administration	Composition Generated (%)	10.00%	0.00%	38.00%	5.00%	3.00%	1.56%	0.00%	0.00%	7.00%	2.00%	0.00%	0.00%	33.44%	100.0%
	Generated (tonnes)	3,877	0	14,734	1,939	1,163	607	0	0	2,714	775	0	0	12,964	38,774
	Potential Diversion (tonnes)	3,877	0	3,831	1,745	582	406	0	0	0	0	0	0	2,593	13,034
Total IC&I Waste Stream	Composition (% total)	15%	4%	25%	4%	8%	5%	2%	0%	9%	10%	1%	8%	8%	100%
	Generated (tonnes)	330,721	97,036	557,463	81,735	185,018	115,529	36,301	5,053	190,302	211,954	31,233	176,838	182,030	2,201,212
	Potential Diversion (tonnes)	295,165	91,211	217,988	72,309	116,790	82,811	19,253	2,782	48,053	0	0	134,278	36,406	1,117,045

TABLE N-7
Estimated Potential Diversion
Extended 3Rs
for Major SIC Groups for Region of Durham
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-ferr	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.39	23.4%	0.0%	10.1%	0.0%	11.9%	5.3%	0.0%	0.0%	2.2%	0.0%	0.0%	31.8%	15.2%	100.0%
	Generated (tonnes)		402	0	174	0	204	92	0	0	38	0	0	547	261	1,719
	Potential Diversion (tonnes)		402	0	27	0	56	51	0	0					52	589
2 Manufacturing	Composition Generated (%)	1.56	11.6%	3.2%	19.2%	2.1%	13.1%	6.3%	0.1%	0.0%	8.8%	2.0%	0.8%	18.3%	14.5%	100.0%
	Generated (tonnes)		7,252	2,032	12,002	1,299	8,185	3,914	63	9	5,508	1,265	531	11,468	9,063	62,590
	Potential Diversion (tonnes)		7,252	2,032	6,546	1,299	8,185	3,914	63	9	2,754			11,468	1,813	45,334
4 Transportation/ Communication/ Utilities	Composition Generated (%)	0.56	13.0%	3.9%	28.5%	2.3%	11.2%	7.8%	0.8%	0.3%	12.3%	1.9%	0.2%	4.5%	13.2%	100.0%
	Generated (tonnes)		1,175	356	2,570	205	1,012	699	74	23	1,110	168	19	406	1,191	9,008
	Potential Diversion (tonnes)		1,175	356	1,314	190	519	487	46	15	139			101	238	4,580
5 Trade: Wholesale	Composition Generated (%)	1.22	27.0%	1.0%	11.5%	0.8%	4.0%	2.5%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	8.7%	100.0%
	Generated (tonnes)		1,747	65	744	52	259	159	0	0	1,081	324	52	1,424	566	6,472
	Potential Diversion (tonnes)		1,747	65	346	47	123	98	0	0	486			712	113	3,737
6 Trade: Retail	Composition Generated (%)	1.09	24.7%	11.3%	27.9%	3.7%	2.9%	0.4%	5.9%	0.1%	4.8%	11.8%	0.7%	1.4%	4.4%	100.0%
	Generated (tonnes)		6,285	2,879	7,107	955	743	93	1,513	20	1,228	2,996	186	357	1,119	25,481
	Potential Diversion (tonnes)		6,285	2,879	290	859	297	62	757	10					224	11,663
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.19	9.7%	2.1%	50.1%	3.1%	2.8%	1.9%	1.1%	0.5%	7.5%	7.7%	0.8%	2.3%	10.3%	100.0%
	Generated (tonnes)		139	30	718	45	40	27	16	8	108	110	12	33	148	1,431
	Potential Diversion (tonnes)		139	30	603	40	20	18	8	4					30	891
8 Services: Non-Commercial	Composition Generated (%)	0.75	6.6%	4.8%	30.0%	1.8%	11.2%	11.5%	0.2%	0.1%	10.1%	10.0%	6.7%	1.0%	6.0%	100.0%
	Generated (tonnes)		1,220	888	5,546	326	2,070	2,130	37	19	1,874	1,849	1,238	185	1,105	18,488
	Potential Diversion (tonnes)		1,220	888	277	293	994	1,053	19	9					221	4,974
9 Services: Commercial	Composition Generated (%)	0.86	13.5%	2.5%	25.2%	10.6%	5.4%	2.7%	2.6%	0.7%	5.3%	25.9%	0.8%	1.7%	3.1%	100.0%
	Generated (tonnes)		2,970	543	5,547	2,339	1,194	602	573	150	1,160	5,715	185	373	682	22,034
	Potential Diversion (tonnes)		2,970	543	1,451	2,105	119	482	286	75					136	8,168
10 Public Administration	Composition Generated (%)	0.23	10.0%	0.0%	38.0%	5.0%	3.0%	1.7%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.3%	100.0%
	Generated (tonnes)		222	0	844	111	67	37	0	0	155	44	0	0	740	2,220
	Potential Diversion (tonnes)		222	0	219	100	33	25	0	0					148	748
Total IC&I Waste Stream	Composition (% total)		14%	5%	24%	4%	9%	5%	2%	0%	8%	8%	1%	10%	10%	100%
	Generated (tonnes)		21,413	6,792	35,252	5,331	13,774	7,752	2,276	229	12,262	12,470	2,223	14,792	14,876	149,443
	Potential Diversion (tonnes)		21,413	6,792	11,073	4,933	10,347	6,190	1,179	122	3,379	0	0	12,281	2,975	80,684

TABLE N-8
Estimated Potential Diversion
Extended 3Rs
for Major SIC Groups for Metropolitan Toronto
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.83	13.9%	0.0%	8.8%	0.0%	16.8%	10.0%	0.0%	0.0%	2.2%	0.0%	0.0%	27.4%	20.9%	100.0%
	Generated (tonnes)		810	0	512	0	980	585	0	0	130	0	0	1,596	1,219	5,831
	Potential Diversion (tonnes)		810	0	79	0	269	327	0	0					244	1,730
2 Manufacturing	Composition Generated (%)	1.70	14.3%	2.9%	22.2%	1.9%	9.9%	5.2%	0.3%	0.1%	9.1%	5.1%	0.6%	14.9%	13.5%	100.0%
	Generated (tonnes)		50,245	10,061	78,093	6,555	34,934	18,295	1,083	206	31,988	17,919	2,166	52,539	47,456	351,541
	Potential Diversion (tonnes)		50,245	10,061	66,169	6,555	34,934	18,295	1,083	206	15,994			52,539	9,491	265,574
4 Transportation/ Communication/ Utilities	Composition Generated (%)	0.74	13.2%	5.3%	27.8%	3.0%	13.1%	9.6%	1.3%	0.3%	11.6%	3.0%	0.3%	3.6%	8.0%	100.0%
	Generated (tonnes)		10,128	4,041	21,300	2,314	10,052	7,311	975	254	8,842	2,292	203	2,749	6,089	76,548
	Potential Diversion (tonnes)		10,128	4,041	10,889	2,140	5,151	5,099	609	158	1,105			687	1,218	41,227
5 Trade: Wholesale	Composition Generated (%)	1.40	27.0%	1.0%	11.5%	0.8%	3.5%	2.0%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.6%	100.0%
	Generated (tonnes)		22,150	820	9,434	656	2,896	1,678	0	0	13,700	4,102	656	18,048	7,895	82,038
	Potential Diversion (tonnes)		22,150	820	4,387	591	1,376	1,032	0	0	6,165			9,024	1,579	47,124
6 Trade: Retail	Composition Generated (%)	1.29	24.7%	11.4%	28.6%	3.7%	2.5%	0.4%	5.7%	0.1%	5.0%	12.1%	0.7%	1.4%	3.7%	100.0%
	Generated (tonnes)		51,172	23,647	59,223	7,705	5,279	727	11,856	206	10,343	25,110	1,535	2,894	7,645	207,343
	Potential Diversion (tonnes)		51,172	23,647	2,416	6,935	2,112	487	5,928	103					1,529	94,330
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.23	9.2%	2.0%	52.0%	3.5%	2.5%	2.2%	1.4%	0.7%	8.1%	7.7%	0.6%	1.6%	8.5%	100.0%
	Generated (tonnes)		3,372	740	18,956	1,273	919	789	502	248	2,952	2,818	211	584	3,118	36,482
	Potential Diversion (tonnes)		3,372	740	15,923	1,146	460	528	251	124					624	23,167
8 Services: Non-Commercial	Composition Generated (%)	0.91	6.6%	4.7%	30.0%	1.7%	11.3%	11.5%	0.2%	0.1%	10.2%	10.0%	6.7%	0.9%	6.1%	100.0%
	Generated (tonnes)		12,462	9,019	56,977	3,238	21,369	21,901	355	178	19,351	18,992	12,810	1,777	11,494	189,922
	Potential Diversion (tonnes)		12,462	9,019	2,849	2,914	10,286	10,835	178	89					2,299	50,930
9 Services: Commercial	Composition Generated (%)	0.89	11.8%	3.3%	29.1%	9.1%	6.8%	4.0%	2.8%	0.7%	6.0%	20.8%	0.7%	1.4%	3.3%	100.0%
	Generated (tonnes)		32,893	9,269	81,092	25,468	19,041	11,099	7,808	2,011	16,668	58,006	2,017	3,895	9,267	278,534
	Potential Diversion (tonnes)		32,893	9,269	29,553	22,922	1,904	8,879	3,904	1,005					1,853	112,182
10 Public Administration	Composition Generated (%)	0.29	10.0%	0.0%	38.0%	5.0%	3.0%	1.6%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.4%	100.0%
	Generated (tonnes)		2,738	0	10,405	1,369	821	428	0	0	1,917	548	0	0	9,155	27,382
	Potential Diversion (tonnes)		2,738	0	2,705	1,232	411	287	0	0					1,831	9,205
Total IC&I Waste Stream	Composition (% total)		14.8%	4.6%	26.8%	3.9%	7.7%	5.0%	1.8%	0.2%	8.4%	10.3%	1.6%	6.7%	8.2%	100.0%
	Generated (tonnes)		185,970	57,597	335,992	48,579	96,292	62,812	22,579	3,102	105,890	129,788	19,598	84,082	103,339	1,255,620
	Potential Diversion (tonnes)		185,970	57,597	134,972	44,434	56,903	45,771	11,953	1,685	23,264	0	0	62,250	20,668	645,468

TABLE N-9
Estimated Potential Diversion
Extended 3Rs
for Major SIC Groups for York Region
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.55	22.7%	0.0%	10.5%	0.0%	11.3%	4.2%	0.0%	0.0%	2.1%	0.0%	0.0%	34.8%	14.5%	100.0%
	Generated (tonnes)		679	0	314	0	338	125	0	0	61	0	0	1,040	434	2,990
	Potential Diversion (tonnes)		679	0	49	0	93	70	0	0					87	977
2 Manufacturing	Composition Generated (%)	1.93	12.6%	2.8%	20.8%	1.8%	12.8%	6.7%	0.2%	0.0%	8.3%	2.8%	0.6%	18.8%	11.8%	100.0%
	Generated (tonnes)		12,575	2,837	20,694	1,795	12,730	6,657	182	25	8,296	2,772	587	18,773	11,795	99,717
	Potential Diversion (tonnes)		12,575	2,837	17,429	1,795	12,730	6,657	182	25	4,148			18,773	2,359	79,509
4 Transportation/ Communication/ Utilities	Composition Generated (%)	1.07	14.1%	5.7%	24.0%	3.3%	14.9%	11.2%	1.0%	0.4%	12.4%	2.0%	0.3%	3.6%	7.0%	100.0%
	Generated (tonnes)		2,064	830	3,522	483	2,191	1,640	140	57	1,822	299	46	533	1,033	14,662
	Potential Diversion (tonnes)		2,064	830	1,801	447	1,123	1,144	88	36	228			133	207	8,101
5 Trade: Wholesale	Composition Generated (%)	1.71	27.0%	1.0%	11.5%	0.8%	3.8%	2.3%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.2%	100.0%
	Generated (tonnes)		9,254	343	3,941	274	1,289	772	0	0	5,724	1,714	274	7,540	3,149	34,273
	Potential Diversion (tonnes)		9,254	343	1,833	247	612	474	0	0	2,576			3,770	630	19,738
6 Trade: Retail	Composition Generated (%)	1.58	23.5%	11.0%	29.0%	3.5%	3.0%	0.3%	6.2%	0.1%	5.1%	11.6%	0.8%	1.4%	4.5%	100.0%
	Generated (tonnes)		13,409	6,290	16,528	1,971	1,691	189	3,560	60	2,916	6,629	445	812	2,582	57,082
	Potential Diversion (tonnes)		13,409	6,290	643	1,774	676	126	1,780	30					516	25,245
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.26	9.7%	2.1%	49.8%	3.1%	3.0%	2.4%	1.1%	0.5%	7.3%	7.7%	0.9%	2.4%	9.9%	100.0%
	Generated (tonnes)		440	95	2,252	140	136	106	51	24	330	349	39	107	449	4,518
	Potential Diversion (tonnes)		440	95	1,891	126	68	71	26	12					90	2,819
8 Services: Non-Commercial	Composition Generated (%)	1.00	6.7%	5.0%	30.0%	1.9%	11.0%	11.5%	0.2%	0.1%	10.0%	10.0%	6.6%	1.2%	5.8%	100.0%
	Generated (tonnes)		1,861	1,373	8,310	535	3,059	3,181	66	33	2,767	2,770	1,818	332	1,595	27,700
	Potential Diversion (tonnes)		1,861	1,373	415	481	1,455	1,569	33	17					319	7,524
9 Services: Commercial	Composition Generated (%)	1.09	11.6%	3.0%	29.8%	8.6%	6.9%	4.4%	2.8%	0.7%	6.1%	20.1%	0.8%	1.7%	3.4%	100.0%
	Generated (tonnes)		6,849	1,773	17,679	5,121	4,092	2,581	1,631	431	3,617	11,930	475	1,025	2,034	59,238
	Potential Diversion (tonnes)		6,849	1,773	6,162	4,609	409	2,064	816	215					407	23,304
10 Public Administration	Composition Generated (%)	0.31	10.0%	0.0%	38.0%	5.0%	3.0%	1.9%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.1%	100.0%
	Generated (tonnes)		249	0	945	124	75	46	0	0	174	50	0	0	824	2,486
	Potential Diversion (tonnes)		249	0	246	112	37	31	0	0					165	839
Total IC&I Waste Stream	Composition (% total)		28%	8%	18%	6%	10%	7%	2%	0%	4%	0%	0%	13%	3%	100%
	Generated (tonnes)		47,379	13,541	74,184	10,443	25,600	15,296	5,631	629	25,708	26,513	3,683	30,161	23,894	302,665
	Potential Diversion (tonnes)		47,379	13,541	30,469	9,590	17,204	12,208	2,924	334	6,951	0	0	22,676	4,779	168,055

TABLE N-10
Estimated Potential Diversion
Extended 3Rs
for Major SIC Groups for Peel Region
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition													Total
			1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	
1 Primary	Composition Generated (%)	0.62	18.0%	0.0%	9.8%	0.0%	13.1%	7.9%	0.0%	0.0%	3.6%	0.0%	0.0%	29.7%	17.8%	100.0%
	Generated (tonnes)		446	0	243	0	325	197	0	0	90	0	0	737	440	2,477
	Potential Diversion (tonnes)		446	0	38	0	89	110	0	0					88	771
2 Manufacturing	Composition Generated (%)	1.78	15.1%	2.9%	18.5%	2.0%	12.9%	6.4%	0.2%	0.1%	9.7%	5.9%	0.6%	15.0%	10.7%	100.0%
	Generated (tonnes)		25,544	4,968	31,236	3,356	21,810	10,858	401	128	16,452	9,940	1,067	25,347	18,095	169,203
	Potential Diversion (tonnes)		25,544	4,968	25,435	3,356	21,810	10,858	401	128	8,226			25,347	3,619	129,693
4 Transportation/	Composition Generated (%)	1.09	13.6%	5.4%	28.7%	3.2%	14.8%	11.1%	1.0%	0.4%	10.9%	2.1%	0.3%	3.6%	4.9%	100.0%
Communication/	Generated (tonnes)		6,726	2,690	14,202	1,563	7,301	5,467	482	184	5,404	1,046	147	1,793	2,396	49,401
Utilities	Potential Diversion (tonnes)		6,726	2,690	7,261	1,445	3,742	3,813	301	115	675			448	479	27,697
5 Trade: Wholesale	Composition Generated (%)	1.57	27.0%	1.0%	11.5%	0.8%	3.8%	2.3%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.2%	100.0%
	Generated (tonnes)		13,036	483	5,552	386	1,816	1,089	0	0	8,063	2,414	386	10,622	4,433	48,280
	Potential Diversion (tonnes)		13,036	483	2,582	348	863	670	0	0	3,628			5,311	887	27,806
6 Trade: Retail	Composition Generated (%)	1.11	24.8%	11.6%	27.4%	3.8%	3.1%	0.4%	6.1%	0.1%	4.3%	11.3%	0.7%	1.5%	4.9%	100.0%
	Generated (tonnes)		4,466	2,087	4,934	686	557	68	1,096	19	773	2,036	123	277	886	18,010
	Potential Diversion (tonnes)		4,466	2,087	199	617	223	46	548	10					177	8,373
7 Financial, Insurance	Composition Generated (%)	0.25	9.9%	2.0%	49.4%	3.0%	3.2%	2.8%	1.0%	0.5%	7.5%	7.5%	0.9%	2.5%	9.8%	100.0%
& Real Estate	Generated (tonnes)		467	96	2,325	141	149	130	48	24	352	355	42	116	461	4,707
	Potential Diversion (tonnes)		467	96	1,953	127	74	87	24	12					92	2,933
8 Services:	Composition Generated (%)	0.90	6.8%	5.0%	30.0%	2.0%	11.0%	11.5%	0.3%	0.1%	9.9%	10.0%	6.5%	1.3%	5.7%	100.0%
Non-Commercial	Generated (tonnes)		2,387	1,769	10,604	699	3,887	4,056	89	44	3,516	3,535	2,305	443	2,013	35,348
	Potential Diversion (tonnes)		2,387	1,769	530	629	1,844	1,999	44	22					403	9,628
9 Services:	Composition Generated (%)	1.06	11.9%	3.9%	28.8%	9.5%	6.7%	4.2%	2.9%	0.7%	5.9%	21.1%	0.6%	0.9%	2.8%	100.0%
Commercial	Generated (tonnes)		8,645	2,828	20,904	6,875	4,889	3,052	2,118	528	4,323	15,332	448	660	2,061	72,662
	Potential Diversion (tonnes)		8,645	2,828	7,199	6,188	489	2,441	1,059	264					412	29,525
10 Public	Composition Generated (%)	0.34	10.0%	0.0%	38.0%	5.0%	3.0%	1.4%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.6%	100.0%
Administration	Generated (tonnes)		553	0	2,101	276	166	76	0	0	387	111	0	0	1,859	5,528
	Potential Diversion (tonnes)		553	0	546	249	83	51	0	0					372	1,853
Total IC&I	Composition (% total)		15.4%	3.7%	22.7%	3.4%	10.1%	6.2%	1.0%	0.2%	9.7%	8.6%	1.1%	9.9%	8.0%	100.0%
Waste Stream	Generated (tonnes)		62,270	14,921	92,101	13,983	40,900	24,992	4,234	927	39,360	34,769	4,518	39,995	32,645	405,616
	Potential Diversion (tonnes)		62,270	14,921	45,743	12,959	29,217	20,075	2,378	551	12,530	0	0	31,106	6,529	238,279

TABLE N-11
Estimated Potential Diversion
Extended 3Rs
for Major SIC Groups for Halton Region
1992

Major IC&I Group		Unit Generation Rate (t/emp/year)	Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-Ferr.	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	0.33	20.0%	0.0%	9.1%	0.0%	14.5%	6.9%	0.0%	0.0%	1.2%	0.0%	0.0%	31.9%	16.5%	100.0%
	Generated (tonnes)		223	0	102	0	163	77	0	0	14	0	0	357	184	1,120
	Potential Diversion (tonnes)		223	0	16	0	45	43	0	0					37	364
2 Manufacturing	Composition Generated (%)	0.98	13.0%	3.3%	16.5%	2.2%	15.7%	7.4%	0.2%	0.0%	8.7%	3.4%	0.8%	16.4%	12.4%	100.0%
	Generated (tonnes)		4,131	1,038	5,251	708	4,980	2,360	50	10	2,758	1,074	249	5,202	3,922	31,735
	Potential Diversion (tonnes)		4,131	1,038	4,126	708	4,980	2,360	50	10	1,379			5,202	784	24,769
4 Transportation/ Communication/ Utilities	Composition Generated (%)	0.53	13.8%	5.2%	26.7%	3.0%	14.3%	10.6%	0.8%	0.4%	11.9%	1.7%	0.3%	3.9%	7.4%	100.0%
	Generated (tonnes)		482	180	933	105	499	370	28	13	415	61	10	137	260	3,492
	Potential Diversion (tonnes)		482	180	477	97	256	258	18	8	52			34	52	1,913
5 Trade: Wholesale	Composition Generated (%)	0.82	27.0%	1.0%	11.5%	0.8%	3.8%	2.3%	0.0%	0.0%	16.7%	5.0%	0.8%	22.0%	9.1%	100.0%
	Generated (tonnes)		1,789	66	762	53	255	153	0	0	1,106	331	53	1,457	600	6,625
	Potential Diversion (tonnes)		1,789	66	354	48	121	94	0	0	498			729	120	3,818
6 Trade: Retail	Composition Generated (%)	0.76	24.4%	11.6%	28.0%	3.8%	2.9%	0.4%	6.1%	0.1%	4.6%	11.8%	0.7%	1.4%	4.3%	100.0%
	Generated (tonnes)		4,127	1,960	4,743	639	494	60	1,027	14	786	2,003	124	229	728	16,936
	Potential Diversion (tonnes)		4,127	1,960	193	575	198	41	513	7					146	7,759
7 Financial, Insurance & Real Estate	Composition Generated (%)	0.12	9.7%	2.0%	50.3%	3.2%	2.8%	2.2%	1.1%	0.6%	7.8%	7.6%	0.8%	2.1%	9.8%	100.0%
	Generated (tonnes)		107	22	555	35	31	24	13	6	86	84	8	24	108	1,103
	Potential Diversion (tonnes)		107	22	466	31	16	16	6	3					22	690
8 Services: Non-Commercial	Composition Generated (%)	0.49	6.7%	4.9%	30.0%	1.9%	11.1%	11.5%	0.2%	0.1%	10.0%	10.0%	6.6%	1.2%	5.8%	100.0%
	Generated (tonnes)		635	468	2,846	180	1,050	1,090	22	11	950	949	625	110	550	9,486
	Potential Diversion (tonnes)		635	468	142	162	500	538	11	6					110	2,572
9 Services: Commercial	Composition Generated (%)	0.58	12.8%	2.8%	26.5%	10.0%	5.8%	3.2%	2.7%	0.7%	5.5%	24.0%	0.9%	1.8%	3.3%	100.0%
	Generated (tonnes)		2,078	451	4,302	1,620	944	524	440	111	885	3,890	140	291	538	16,214
	Potential Diversion (tonnes)		2,078	451	1,223	1,458	94	419	220	56					108	6,107
10 Public Administration	Composition Generated (%)	0.17	10.0%	0.0%	38.0%	5.0%	3.0%	1.6%	0.0%	0.0%	7.0%	2.0%	0.0%	0.0%	33.4%	100.0%
	Generated (tonnes)		116	0	440	58	35	18	0	0	81	23	0	0	387	1,158
	Potential Diversion (tonnes)		116	0	114	52	17	12	0	0					77	389
Total IC&I Waste Stream	Composition (% total)		28%	9%	15%	6%	13%	8%	2%	0%	4%	0%	0%	12%	3%	100%
	Generated (tonnes)		13,689	4,185	19,934	3,399	8,451	4,675	1,580	166	7,081	8,415	1,210	7,807	7,276	87,868
	Potential Diversion (tonnes)		13,689	4,185	7,111	3,133	6,227	3,780	819	90	1,929	0	0	5,965	1,455	48,383

TABLE N-12
Estimated Potential Diversion
Under Extended 3Rs System
for Major SIC Groups for GTA
1992

Major IC&I Group		Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-ferr	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	18.11%	0.00%	9.51%	0.00%	14.22%	7.60%	0.00%	0.00%	2.36%	0.00%	0.00%	30.25%	17.96%	100.0%
	Generated (tonnes)	2,560	0	1,344	0	2,010	1,074	0	0	333	0	0	4,276	2,539	14,136
	Potential Diversion (tonnes)	2,560	0	208	0	553	602	0	0	0	0	0	0	508	4,431
2 Manufacturing	Composition Generated (%)	13.95%	2.93%	20.60%	1.92%	11.56%	5.89%	0.25%	0.05%	9.09%	4.61%	0.64%	15.85%	12.64%	100.0%
	Generated (tonnes)	99,747	20,936	147,276	13,714	82,640	42,084	1,780	378	65,001	32,970	4,600	113,328	90,331	714,786
	Potential Diversion (tonnes)	99,747	20,936	119,705	13,714	82,640	42,084	1,780	378	32,501	0	0	113,328	18,066	544,879
4 Transportation/ Communication/ Utilities	Composition Generated (%)	13.44%	5.29%	27.78%	3.05%	13.75%	10.11%	1.11%	0.35%	11.49%	2.52%	0.28%	3.67%	7.16%	100.0%
	Generated (tonnes)	20,576	8,097	42,527	4,670	21,055	15,486	1,699	531	17,593	3,866	424	5,618	10,969	153,110
	Potential Diversion (tonnes)	20,576	8,097	21,742	4,320	10,791	10,802	1,062	332	2,199	0	0	1,404	2,194	83,517
5 Trade: Wholesale	Composition Generated (%)	27.00%	1.00%	11.50%	0.80%	3.67%	2.17%	0.00%	0.00%	16.70%	5.00%	0.80%	22.00%	9.37%	100.0%
	Generated (tonnes)	47,976	1,777	20,434	1,422	6,515	3,851	0	0	29,674	8,884	1,422	39,091	16,643	177,688
	Potential Diversion (tonnes)	47,976	1,777	9,502	1,279	3,094	2,368	0	0	13,353	0	0	19,546	3,329	102,224
6 Trade: Retail	Composition Generated (%)	24.46%	11.35%	28.49%	3.68%	2.70%	0.35%	5.86%	0.10%	4.94%	11.94%	0.74%	1.41%	3.99%	100.0%
	Generated (tonnes)	79,459	36,864	92,535	11,956	8,764	1,137	19,052	320	16,046	38,775	2,414	4,569	12,960	324,851
	Potential Diversion (tonnes)	79,459	36,864	3,742	10,761	3,506	762	9,526	160	0	0	0	0	2,592	147,371
7 Financial, Insurance & Real Estate	Composition Generated (%)	9.38%	2.04%	51.42%	3.39%	2.64%	2.23%	1.31%	0.64%	7.94%	7.70%	0.65%	1.79%	8.88%	100.0%
	Generated (tonnes)	4,525	982	24,806	1,633	1,276	1,076	630	310	3,828	3,716	312	863	4,284	48,241
	Potential Diversion (tonnes)	4,525	982	20,837	1,470	638	721	315	155	0	0	0	0	857	30,500
8 Services: Non-Commercial	Composition Generated (%)	6.61%	4.81%	30.00%	1.77%	11.19%	11.52%	0.20%	0.10%	10.13%	10.00%	6.69%	1.01%	5.96%	100.0%
	Generated (tonnes)	18,565	13,516	84,283	4,978	31,435	32,358	570	285	28,458	28,094	18,796	2,848	16,757	280,943
	Potential Diversion (tonnes)	18,565	13,516	4,214	4,480	15,080	15,994	285	142	0	0	0	0	3,351	75,628
9 Services: Commercial	Composition Generated (%)	11.91%	3.31%	28.87%	9.23%	6.72%	3.98%	2.80%	0.72%	5.94%	21.14%	0.73%	1.39%	3.25%	100.0%
	Generated (tonnes)	53,435	14,865	129,524	41,424	30,161	17,856	12,570	3,231	26,653	94,873	3,265	6,244	14,582	448,683
	Potential Diversion (tonnes)	53,435	14,865	45,588	37,281	3,016	14,285	6,285	1,615	0	0	0	0	2,916	179,286
10 Public Administration	Composition Generated (%)	10.00%	0.00%	38.00%	5.00%	3.00%	1.56%	0.00%	0.00%	7.00%	2.00%	0.00%	0.00%	33.44%	100.0%
	Generated (tonnes)	3,877	0	14,734	1,939	1,163	607	0	0	2,714	775	0	0	12,964	38,774
	Potential Diversion (tonnes)	3,877	0	3,831	1,745	582	406	0	0	0	0	0	0	2,593	13,034
Total IC&I Waste Stream	Composition (% total)	15%	4%	25%	4%	8%	5%	2%	0%	9%	10%	1%	8%	8%	100%
	Generated (tonnes)	330,721	97,036	557,463	81,735	185,018	115,529	36,301	5,053	190,302	211,954	31,233	176,838	182,030	2,201,212
	Potential Diversion (tonnes)	330,721	97,036	229,368	75,050	119,898	88,024	19,253	2,782	48,053	0	0	134,278	36,406	1,180,870

TABLE N-13
Estimated Diversion
Under Expanded 3Rs System
for Major SIC Groups for GTA
1992

Major IC&I Group		Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-ferr	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	18.11%	0.00%	9.51%	0.00%	14.22%	7.60%	0.00%	0.00%	2.36%	0.00%	0.00%	30.25%	17.96%	100.0%
	Generated (tonnes)	2,560	0	1,344	0	2,010	1,074	0	0	333	0	0	4,276	2,539	14,136
	Potential Diversion (tonnes)	2,560	0	1,210	0	2,010	1,074	0	0	250			4,276	508	11,888
2 Manufacturing	Composition Generated (%)	13.95%	2.93%	20.60%	1.92%	11.56%	5.89%	0.25%	0.05%	9.09%	4.61%	0.64%	15.85%	12.64%	100.0%
	Generated (tonnes)	99,747	20,936	147,276	13,714	82,640	42,084	1,780	378	65,001	32,970	4,600	113,328	90,331	714,786
	Potential Diversion (tonnes)	99,747	20,936	132,549	13,714	82,640	42,084	1,780	378	32,501			113,328	18,066	557,723
4 Transportation / Communication / Utilities	Composition Generated (%)	13.44%	5.29%	27.78%	3.05%	13.75%	10.11%	1.11%	0.35%	11.49%	2.52%	0.28%	3.67%	7.16%	100.0%
	Generated (tonnes)	20,576	8,097	42,527	4,670	21,055	15,486	1,699	531	17,593	3,866	424	5,618	10,969	153,110
	Potential Diversion (tonnes)	20,576	8,097	38,274	4,670	21,055	15,486	1,699	531	12,095			5,618	2,194	130,294
5 Trade: Wholesale	Composition Generated (%)	27.00%	1.00%	11.50%	0.80%	3.67%	2.17%	0.00%	0.00%	16.70%	5.00%	0.80%	22.00%	9.37%	100.0%
	Generated (tonnes)	47,976	1,777	20,434	1,422	6,515	3,851	0	0	29,674	8,884	1,422	39,091	16,643	177,688
	Potential Diversion (tonnes)	47,976	1,777	18,391	1,422	6,515	3,851	0	0	22,255			39,091	3,329	144,605
6 Trade: Retail	Composition Generated (%)	24.46%	11.35%	28.49%	3.68%	2.70%	0.35%	5.86%	0.10%	4.94%	11.94%	0.74%	1.41%	3.99%	100.0%
	Generated (tonnes)	79,459	36,864	92,535	11,956	8,764	1,137	19,052	320	16,046	38,775	2,414	4,569	12,960	324,851
	Potential Diversion (tonnes)	79,459	36,864	83,281	11,956	8,764	1,137	19,052	320	12,035			4,569	2,592	260,029
7 Financial, Insurance & Real Estate	Composition Generated (%)	9.38%	2.04%	51.42%	3.39%	2.64%	2.23%	1.31%	0.64%	7.94%	7.70%	0.65%	1.79%	8.88%	100.0%
	Generated (tonnes)	4,525	982	24,806	1,633	1,276	1,076	630	310	3,828	3,716	312	863	4,284	48,241
	Potential Diversion (tonnes)	4,525	982	22,325	1,633	1,276	1,076	630	310	2,871			863	857	37,349
8 Services: Non-Commercial	Composition Generated (%)	6.61%	4.81%	30.00%	1.77%	11.19%	11.52%	0.20%	0.10%	10.13%	10.00%	6.69%	1.01%	5.96%	100.0%
	Generated (tonnes)	18,565	13,516	84,283	4,978	31,435	32,358	570	285	28,458	28,094	18,796	2,848	16,757	280,943
	Potential Diversion (tonnes)	18,565	13,516	71,640	4,978	31,435	32,358	570	285	21,344			2,848	3,351	200,889
9 Services: Commercial	Composition Generated (%)	11.91%	3.31%	28.87%	9.23%	6.72%	3.98%	2.80%	0.72%	5.94%	21.14%	0.73%	1.39%	3.25%	100.0%
	Generated (tonnes)	53,435	14,865	129,524	41,424	30,161	17,856	12,570	3,231	26,653	94,873	3,265	6,244	14,582	448,683
	Potential Diversion (tonnes)	53,435	14,865	116,572	41,424	30,161	17,856	12,570	3,231	19,990			6,244	2,916	319,263
10 Public Administration	Composition Generated (%)	10.00%	0.00%	38.00%	5.00%	3.00%	1.56%	0.00%	0.00%	7.00%	2.00%	0.00%	0.00%	33.44%	100.0%
	Generated (tonnes)	3,877	0	14,734	1,939	1,163	607	0	0	2,714	775	0	0	12,964	38,774
	Potential Diversion (tonnes)	3,877	0	13,261	1,939	1,163	607	0	0	2,036			0	2,593	25,475
Total IC&I Waste Stream	Composition (% total)	15%	4%	25%	4%	8%	5%	2%	0%	9%	10%	1%	8%	8%	100%
	Generated (tonnes)	330,721	97,036	557,463	81,735	185,018	115,529	36,301	5,053	190,302	211,954	31,233	176,838	182,030	2,201,212
	Potential Diversion (tonnes)	330,721	97,036	497,502	81,735	185,018	115,529	36,301	5,053	125,377	0	0	176,838	36,406	1,687,516

TABLE N-14
Estimated Diversion
Under Expanded 3Rs With Organics System
for Major SIC Groups for GTA
1992

Major IC&I Group		Waste Composition 1 OCC	2 ONP	3 Paper	4 Glass	5 Ferrous	6 Non-ferr	7 HDPE	8 PET	9 Plastic	10 Food	11 Yard	12 Wood	13 Other	Total
1 Primary	Composition Generated (%)	18.11%	0.00%	9.51%	0.00%	14.22%	7.60%	0.00%	0.00%	2.36%	0.00%	0.00%	30.25%	17.96%	100.0%
	Generated (tonnes)	2,560	0	1,344	0	2,010	1,074	0	0	333	0	0	4,276	2,539	14,136
	Potential Diversion (tonnes)	2,560	0	1,210	0	2,010	1,074	0	0	250	0	0	4,276	508	11,888
2 Manufacturing	Composition Generated (%)	13.95%	2.93%	20.60%	1.92%	11.56%	5.89%	0.25%	0.05%	9.09%	4.61%	0.64%	15.85%	12.64%	100.0%
	Generated (tonnes)	99,747	20,936	147,276	13,714	82,640	42,084	1,780	378	65,001	32,970	4,600	113,328	90,331	714,786
	Potential Diversion (tonnes)	99,747	20,936	132,549	13,714	82,640	42,084	1,780	378	32,501	32,970	4,600	113,328	18,066	595,293
4 Transportation/ Communication/ Utilities	Composition Generated (%)	13.44%	5.29%	27.78%	3.05%	13.75%	10.11%	1.11%	0.35%	11.49%	2.52%	0.28%	3.67%	7.16%	100.0%
	Generated (tonnes)	20,576	8,097	42,527	4,670	21,055	15,486	1,699	531	17,593	3,866	424	5,618	10,969	153,110
	Potential Diversion (tonnes)	20,576	8,097	38,274	4,670	21,055	15,486	1,699	531	12,095	3,866	424	5,618	2,194	134,584
5 Trade: Wholesale	Composition Generated (%)	27.00%	1.00%	11.50%	0.80%	3.67%	2.17%	0.00%	0.00%	16.70%	5.00%	0.80%	22.00%	9.37%	100.0%
	Generated (tonnes)	47,976	1,777	20,434	1,422	6,515	3,851	0	0	29,674	8,884	1,422	39,091	16,643	177,688
	Potential Diversion (tonnes)	47,976	1,777	18,391	1,422	6,515	3,851	0	0	22,255	8,884	1,422	39,091	3,329	154,911
6 Trade: Retail	Composition Generated (%)	24.46%	11.35%	28.49%	3.68%	2.70%	0.35%	5.86%	0.10%	4.94%	11.94%	0.74%	1.41%	3.99%	100.0%
	Generated (tonnes)	79,459	36,864	92,535	11,956	8,764	1,137	19,052	320	16,046	38,775	2,414	4,569	12,960	324,851
	Potential Diversion (tonnes)	79,459	36,864	83,281	11,956	8,764	1,137	19,052	320	12,035	34,898	2,172	4,569	2,592	297,099
7 Financial, Insurance & Real Estate	Composition Generated (%)	9.38%	2.04%	51.42%	3.39%	2.64%	2.23%	1.31%	0.64%	7.94%	7.70%	0.65%	1.79%	8.88%	100.0%
	Generated (tonnes)	4,525	982	24,806	1,633	1,276	1,076	630	310	3,828	3,716	312	863	4,284	48,241
	Potential Diversion (tonnes)	4,525	982	22,325	1,633	1,276	1,076	630	310	2,871	3,716	312	863	857	41,376
8 Services: Non-Commercial	Composition Generated (%)	6.61%	4.81%	30.00%	1.77%	11.19%	11.52%	0.20%	0.10%	10.13%	10.00%	6.69%	1.01%	5.96%	100.0%
	Generated (tonnes)	18,565	13,516	84,283	4,978	31,435	32,358	570	285	28,458	28,094	18,796	2,848	16,757	280,943
	Potential Diversion (tonnes)	18,565	13,516	71,640	4,978	31,435	32,358	570	285	21,344	28,094	18,796	2,848	3,351	247,780
9 Services: Commercial	Composition Generated (%)	11.91%	3.31%	28.87%	9.23%	6.72%	3.98%	2.80%	0.72%	5.94%	21.14%	0.73%	1.39%	3.25%	100.0%
	Generated (tonnes)	53,435	14,865	129,524	41,424	30,161	17,856	12,570	3,231	26,653	94,873	3,265	6,244	14,582	448,683
	Potential Diversion (tonnes)	53,435	14,865	116,572	41,424	30,161	17,856	12,570	3,231	19,990	94,873	3,265	6,244	2,916	417,402
10 Public Administration	Composition Generated (%)	10.00%	0.00%	38.00%	5.00%	3.00%	1.56%	0.00%	0.00%	7.00%	2.00%	0.00%	0.00%	33.44%	100.0%
	Generated (tonnes)	3,877	0	14,734	1,939	1,163	607	0	0	2,714	775	0	0	12,964	38,774
	Potential Diversion (tonnes)	3,877	0	13,261	1,939	1,163	607	0	0	2,036	775	0	0	2,593	26,251
Total IC&I Waste Stream	Composition (% total)	15%	4%	25%	4%	8%	5%	2%	0%	9%	10%	1%	8%	8%	100%
	Generated (tonnes)	330,721	97,036	557,463	81,735	185,018	115,529	36,301	5,053	190,302	211,954	31,233	176,838	182,030	2,201,212
	Potential Diversion (tonnes)	330,721	97,036	497,502	81,735	185,018	115,529	36,301	5,053	125,377	208,077	30,991	176,838	36,406	1,926,584

Table N-15
Estimated IC&I Waste Generation and Reduction
for Durham Region
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1996	219,429	173,262	1,787	3,465	462	5,714	213,716
1997	227,692	179,786	2,317	4,495	599	7,411	220,281
1998	236,267	186,557	2,886	5,597	746	9,228	227,039
1999	245,164	193,581	3,493	6,775	903	11,171	233,992
2000	254,397	200,872	4,143	8,035	1,071	13,248	241,149
2001	263,976	208,436	4,836	9,380	1,250	15,465	248,511
2002	273,917	216,285	5,883	10,814	1,441	18,138	255,779
2003	284,232	224,429	7,002	12,344	1,645	20,990	263,241
2004	294,936	232,882	8,197	13,973	1,862	24,032	270,904
2005	306,042	241,651	9,473	15,707	2,093	27,273	278,769
2006	317,568	250,751	10,832	17,553	2,339	30,724	286,844
2007	329,526	260,194	12,281	19,515	2,600	34,396	295,130
2008	341,935	269,992	13,824	21,599	2,878	38,301	303,634
2009	354,811	280,159	15,465	23,814	3,173	42,451	312,360
2010	368,173	290,710	17,210	26,164	3,486	46,860	321,314
2011	382,037	301,656	19,065	28,657	3,818	51,540	330,497
2012	396,424	313,016	21,035	31,302	4,170	56,507	339,917
2013	411,352	324,803	23,126	34,104	4,544	61,774	349,578
2014	426,843	337,036	25,345	37,074	4,939	67,358	359,485
2015	442,916	349,727	27,698	40,219	5,358	73,275	369,641
Total	**6,377,638**	**5,035,783**	**235,898**	**370,584**	**49,374**	**655,855**	**5,721,782**

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 11.6 in Service Technical Appendix) multiplied by projected employment.
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 11.7 of the Service Technical Appendix.
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overa unit generation rate for each region.
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0.5% per year until year 2015.
5. Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0.25% per year.

Table N-16
Estimated IC&I Waste Generation and Reduction
for Metro Toronto
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1996	1,561,031	1,291,753	15,191	25,835	2,693	43,719	1,517,312
1997	1,572,068	1,300,887	19,123	32,522	3,390	55,035	1,517,033
1998	1,583,183	1,310,084	23,110	39,303	4,096	66,509	1,516,674
1999	1,594,375	1,319,345	27,152	46,177	4,813	78,142	1,516,233
2000	1,605,648	1,328,674	31,250	53,147	5,539	89,937	1,515,711
2001	1,617,000	1,338,068	35,405	60,213	6,276	101,894	1,515,106
2002	1,630,761	1,349,455	42,886	67,473	7,033	117,391	1,513,370
2003	1,644,639	1,360,938	50,491	74,852	7,802	133,144	1,511,494
2004	1,658,635	1,372,520	58,222	82,351	8,583	149,157	1,509,478
2005	1,672,750	1,384,201	66,082	89,973	9,378	165,433	1,507,318
2006	1,686,985	1,395,980	74,071	97,719	10,185	181,975	1,505,011
2007	1,701,341	1,407,860	82,191	105,590	11,006	198,786	1,502,555
2008	1,715,821	1,419,842	90,444	113,587	11,839	215,870	1,499,950
2009	1,730,422	1,431,924	98,831	121,714	12,686	233,231	1,497,191
2010	1,745,148	1,444,110	107,355	129,970	13,547	250,872	1,494,276
2011	1,760,000	1,456,400	116,017	138,358	14,421	268,796	1,491,204
2012	1,770,702	1,465,256	124,517	146,526	15,272	286,315	1,484,387
2013	1,781,470	1,474,166	133,117	154,787	16,133	304,038	1,477,432
2014	1,792,303	1,483,130	141,817	163,144	17,004	321,966	1,470,337
2015	1,803,201	1,492,149	150,618	171,597	17,886	340,100	1,463,101
Total	**33,627,483**	**27,826,742**	**1,487,890**	**1,914,837**	**199,583**	**3,602,310**	**30,025,173**

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 11.6 in Service Technical Appendix) multiplied by projected employment.
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 11.7 of the Service Technical Appendix.
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overa unit generation rate for each region.
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0.5% per year until year 2015.
5. Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0.25% per year.

Table N-17
Estimated IC&I Waste Generation and Reduction
for York Region
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1996	479,646	353,979	2,520	7,080	1,257	10,857	468,789
1997	498,009	367,530	3,271	9,188	1,631	14,090	483,918
1998	517,076	381,602	4,076	11,448	2,032	17,556	499,520
1999	536,873	396,212	4,937	13,867	2,462	21,266	515,607
2000	557,427	411,381	5,858	16,455	2,921	25,234	532,193
2001	578,768	427,131	6,843	19,221	3,412	29,475	549,293
2002	600,926	443,484	9,504	22,174	3,936	35,614	565,312
2003	623,933	460,463	12,359	25,325	4,495	42,180	581,754
2004	647,822	478,092	15,418	28,686	5,092	49,196	598,626
2005	672,624	496,397	18,694	32,266	5,727	56,687	615,937
2006	698,376	515,401	22,198	36,078	6,404	64,681	633,695
2007	725,113	535,133	25,943	40,135	7,124	73,203	651,911
2008	752,875	555,621	29,942	44,450	7,890	82,282	670,592
2009	781,698	576,893	34,210	49,036	8,704	91,950	689,748
2010	811,627	598,980	38,760	53,908	9,569	102,237	709,389
2011	842,700	621,913	43,609	59,082	10,487	113,178	729,522
2012	856,709	632,252	47,754	63,225	11,223	122,202	734,507
2013	870,951	642,762	52,025	67,490	11,980	131,495	739,456
2014	885,430	653,447	56,249	71,879	12,759	140,887	744,543
2015	900,150	664,311	60,598	76,396	13,561	150,555	749,595
Total	**13,838,732**	**10,212,984**	**494,768**	**747,389**	**132,667**	**1,374,824**	**12,463,908**

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 11.6 in Service Technical Appendix) multiplied by projected employment.
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 11.7 of the Service Technical Appendix.
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overa unit generation rate for each region.
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0.5% per year until year 2015.
5. Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0.25% per year.

Table N-18
Estimated IC&I Waste Generation and Reduction
for Peel Region
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1996	612,752	451,598	3,414	9,032	1,612	14,058	598,695
1997	629,421	463,883	4,384	11,597	2,069	18,050	611,371
1998	646,544	476,503	5,404	14,295	2,551	22,249	624,295
1999	664,133	489,466	6,476	17,131	3,057	26,664	637,469
2000	682,199	502,781	7,602	20,111	3,588	31,302	650,897
2001	700,757	516,458	8,780	23,241	4,147	36,167	664,590
2002	719,819	530,507	10,923	26,525	4,733	42,181	677,638
2003	739,401	544,939	13,182	29,972	5,348	48,501	690,900
2004	759,516	559,763	15,545	33,586	5,993	55,123	704,393
2005	780,177	574,990	18,032	37,374	6,669	62,075	718,102
2006	801,400	590,632	20,643	41,344	7,377	69,364	732,037
2007	823,202	606,700	23,382	45,502	8,119	77,004	746,198
2008	845,595	623,204	26,256	49,856	8,896	85,008	760,588
2009	868,599	640,158	29,268	54,413	9,709	93,390	775,209
2010	892,228	657,572	32,425	59,182	10,560	102,166	790,062
2011	916,500	675,461	35,732	64,169	11,449	111,350	805,150
2012	926,562	682,876	38,576	68,288	12,184	119,048	807,514
2013	936,736	690,375	41,478	72,489	12,934	126,901	809,835
2014	947,021	697,954	44,439	76,775	13,699	134,912	812,108
2015	957,420	705,618	47,460	81,146	14,479	143,085	814,335
Total	**15,849,583**	**11,681,438**	**433,397**	**836,029**	**149,169**	**1,418,596**	**14,431,387**

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 11.6 in Service Technical Appendix) multiplied by projected employment.
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 11.7 of the Service Technical Appendix.
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overa unit generation rate for each region.
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0.5% per year until year 2015.
5. Reduction in C&D,waste generation due mostly to better waste management was assumed to be in increments of 0.25% per year.

Table N-19
Estimated IC&I Waste Diversion
for Six IC&I Systems in Durham Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	213,716	60,451	71,858	97,587	115,383	129,174	131,879
1997	220,281	62,308	74,065	100,584	118,927	133,143	135,930
1998	227,039	64,220	76,337	103,670	122,576	137,227	140,100
1999	233,992	66,187	78,675	106,845	126,330	141,430	144,391
2000	241,149	68,211	81,081	110,113	130,193	145,755	148,807
2001	248,511	70,293	83,557	113,475	134,168	150,205	153,350
2002	255,779	72,349	86,000	116,793	138,092	154,598	157,835
2003	263,241	74,460	88,509	120,201	142,121	159,108	162,439
2004	270,904	76,627	91,086	123,700	146,258	163,740	167,168
2005	278,769	78,852	93,730	127,291	150,505	168,494	172,021
2006	286,844	81,136	96,445	130,978	154,864	173,374	177,004
2007	295,130	83,480	99,232	134,762	159,338	178,383	182,117
2008	303,634	85,885	102,091	138,645	163,929	183,523	187,365
2009	312,360	88,354	105,025	142,629	168,640	188,797	192,749
2010	321,314	90,886	108,035	146,718	173,474	194,209	198,274
2011	330,497	93,484	111,123	150,911	178,432	199,759	203,941
2012	339,917	96,148	114,290	155,212	183,517	205,453	209,754
2013	349,578	98,881	117,538	159,623	188,733	211,292	215,715
2014	359,485	101,683	120,869	164,147	194,082	217,280	221,829
2015	369,641	104,556	124,284	168,785	199,565	223,419	228,096
Total	5,721,782	1,618,453	1,923,831	2,612,669	3,089,127	3,458,364	3,530,764

(1) Refer to Table N-15 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-20
Estimated IC&I Waste Diversion
for Six IC&I Systems in Metro Toronto
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	1,517,312	429,184	510,165	692,832	819,180	917,095	936,294
1997	1,517,033	429,105	510,071	692,705	819,030	916,927	936,122
1998	1,516,674	429,004	509,950	692,541	818,836	916,709	935,900
1999	1,516,233	428,879	509,802	692,339	818,598	916,443	935,628
2000	1,515,711	428,731	509,627	692,101	818,316	916,127	935,306
2001	1,515,106	428,560	509,423	691,825	817,989	915,761	934,933
2002	1,513,370	428,069	508,839	691,032	817,052	914,712	933,862
2003	1,511,494	427,539	508,209	690,176	816,039	913,579	932,704
2004	1,509,478	426,968	507,531	689,255	814,951	912,360	931,460
2005	1,507,318	426,357	506,804	688,268	813,784	911,054	930,127
2006	1,505,011	425,705	506,029	687,215	812,539	909,660	928,703
2007	1,502,555	425,010	505,203	686,094	811,213	908,176	927,188
2008	1,499,950	424,273	504,327	684,904	809,807	906,601	925,581
2009	1,497,191	423,493	503,400	683,644	808,317	904,933	923,878
2010	1,494,276	422,668	502,420	682,313	806,743	903,172	922,079
2011	1,491,204	421,799	501,387	680,911	805,085	901,315	920,184
2012	1,484,387	419,871	499,094	677,798	801,404	897,194	915,977
2013	1,477,432	417,904	496,756	674,622	797,649	892,990	911,685
2014	1,470,337	415,897	494,370	671,382	793,819	888,702	907,307
2015	1,463,101	413,850	491,938	668,078	789,912	884,329	902,842
Total	**30,025,173**	**8,492,866**	**10,095,345**	**13,710,034**	**16,210,262**	**18,147,839**	**18,527,760**

(1) Refer to Table N-16 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-21
Estimated IC&I Waste Diversion
for Six IC&I Systems in York Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	468,789	132,601	157,621	214,058	253,094	283,346	289,278
1997	483,918	136,880	162,708	220,966	261,262	292,490	298,614
1998	499,520	141,293	167,953	228,090	269,686	301,920	308,241
1999	515,607	145,844	173,362	235,436	278,371	311,644	318,168
2000	532,193	150,535	178,939	243,009	287,325	321,668	328,402
2001	549,293	155,372	184,688	250,817	296,557	332,004	338,954
2002	565,312	159,903	190,075	258,132	305,206	341,686	348,840
2003	581,754	164,554	195,603	265,639	314,082	351,624	358,985
2004	598,626	169,326	201,276	273,343	323,191	361,822	369,397
2005	615,937	174,223	207,096	281,248	332,537	372,285	380,079
2006	633,695	179,246	213,067	289,357	342,125	383,019	391,037
2007	651,911	184,398	219,192	297,674	351,959	394,028	402,277
2008	670,592	189,683	225,473	306,204	362,045	405,320	413,805
2009	689,748	195,101	231,914	314,951	372,387	416,898	425,626
2010	709,389	200,657	238,518	323,920	382,991	428,770	437,746
2011	729,522	206,351	245,287	333,113	393,861	440,939	450,169
2012	734,507	207,761	246,963	335,389	396,553	443,952	453,246
2013	739,456	209,161	248,627	337,649	399,224	446,943	456,299
2014	744,543	210,600	250,337	339,972	401,970	450,017	459,438
2015	749,595	212,029	252,036	342,279	404,698	453,071	462,556
Total	12,463,908	3,525,518	4,190,732	5,691,245	6,729,127	7,533,445	7,691,156

(1) Refer to Table N-17 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-22
Estimated IC&I Waste Diversion
for Six IC&I Systems in Peel Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	598,695	169,346	201,299	273,375	323,229	361,863	369,439
1997	611,371	172,931	205,561	279,163	330,073	369,525	377,261
1998	624,295	176,587	209,906	285,064	337,050	377,337	385,236
1999	637,469	180,313	214,336	291,080	344,162	385,299	393,366
2000	650,897	184,112	218,851	297,211	351,412	393,416	401,652
2001	664,590	187,985	223,455	303,464	358,805	401,692	410,101
2002	677,638	191,675	227,842	309,422	365,849	409,578	418,153
2003	690,900	195,427	232,301	315,477	373,009	417,594	426,336
2004	704,393	199,243	236,838	321,639	380,294	425,750	434,663
2005	718,102	203,121	241,447	327,898	387,696	434,036	443,122
2006	732,037	207,063	246,132	334,261	395,219	442,458	451,721
2007	746,198	211,068	250,894	340,728	402,864	451,018	460,460
2008	760,588	215,138	255,732	347,298	410,633	459,715	469,339
2009	775,209	219,274	260,648	353,975	418,527	468,553	478,362
2010	790,062	223,476	265,642	360,757	426,546	477,530	487,527
2011	805,150	227,743	270,715	367,646	434,692	486,649	496,837
2012	807,514	228,412	271,510	368,726	435,968	488,078	498,296
2013	809,835	229,069	272,290	369,785	437,221	489,481	499,728
2014	812,108	229,712	273,055	370,823	438,448	490,855	501,131
2015	814,335	230,341	273,803	371,840	439,651	492,201	502,505
Total	14,431,387	4,082,036	4,852,256	6,589,631	7,791,348	8,722,631	8,905,237

(1) Refer to Table N-18 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-23
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in Durham Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed System (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	213,716	153,265	141,858	116,129	98,333	84,542	81,837
1997	220,281	157,973	146,216	119,697	101,354	87,139	84,351
1998	227,039	162,819	150,702	123,369	104,463	89,812	86,939
1999	233,992	167,806	155,317	127,147	107,662	92,563	89,602
2000	241,149	172,938	160,067	131,036	110,955	95,393	92,342
2001	248,511	178,218	164,954	135,036	114,343	98,306	95,161
2002	255,779	183,430	169,779	138,986	117,687	101,181	97,944
2003	263,241	188,781	174,732	143,041	121,120	104,133	100,802
2004	270,904	194,277	179,818	147,205	124,646	107,164	103,736
2005	278,769	199,917	185,039	151,478	128,265	110,275	106,748
2006	286,844	205,708	190,399	155,866	131,980	113,469	109,840
2007	295,130	211,650	195,899	160,369	135,793	116,747	113,013
2008	303,634	217,749	201,544	164,989	139,705	120,111	116,269
2009	312,360	224,007	207,336	169,731	143,720	123,563	119,611
2010	321,314	230,427	213,278	174,596	147,840	127,105	123,039
2011	330,497	237,013	219,374	179,586	152,065	130,738	126,556
2012	339,917	243,769	225,627	184,705	156,400	134,464	130,163
2013	349,578	250,697	232,039	189,954	160,845	138,286	133,862
2014	359,485	257,802	238,616	195,338	165,403	142,205	137,656
2015	369,641	265,085	245,357	200,856	170,076	146,222	141,545
Total	**5,721,782**	**4,103,329**	**3,797,951**	**3,109,114**	**2,632,655**	**2,263,418**	**2,191,018**

(1) Refer to Table N-15 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-24
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in Metro Toronto
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed System (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	1,517,312	1,088,128	1,007,147	824,480	698,132	600,217	581,018
1997	1,517,033	1,087,928	1,006,962	824,329	698,004	600,107	580,911
1998	1,516,674	1,087,670	1,006,724	824,133	697,838	599,965	580,774
1999	1,516,233	1,087,354	1,006,431	823,894	697,635	599,790	580,605
2000	1,515,711	1,086,980	1,006,085	823,610	697,395	599,584	580,405
2001	1,515,106	1,086,546	1,005,683	823,281	697,117	599,344	580,173
2002	1,513,370	1,085,301	1,004,531	822,338	696,318	598,658	579,508
2003	1,511,494	1,083,956	1,003,286	821,319	695,455	597,916	578,790
2004	1,509,478	1,082,510	1,001,947	820,223	694,527	597,118	578,018
2005	1,507,318	1,080,960	1,000,513	819,049	693,533	596,263	577,191
2006	1,505,011	1,079,306	998,982	817,796	692,472	595,351	576,307
2007	1,502,555	1,077,545	997,352	816,462	691,342	594,380	575,367
2008	1,499,950	1,075,677	995,623	815,046	690,144	593,349	574,370
2009	1,497,191	1,073,698	993,791	813,547	688,874	592,258	573,313
2010	1,494,276	1,071,608	991,857	811,963	687,533	591,105	572,197
2011	1,491,204	1,069,405	989,818	810,294	686,119	589,889	571,021
2012	1,484,387	1,064,516	985,292	806,589	682,983	587,192	568,410
2013	1,477,432	1,059,528	980,676	802,810	679,783	584,441	565,747
2014	1,470,337	1,054,440	975,966	798,955	676,518	581,635	563,030
2015	1,463,101	1,049,251	971,164	795,023	673,189	578,772	560,259
Total	**30,025,173**	**21,532,307**	**19,929,828**	**16,315,139**	**13,814,911**	**11,877,334**	**11,497,413**

(1) Refer to Table N-16 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-25
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in York Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed Systems (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	468,789	336,188	311,168	254,732	215,695	185,443	179,511
1997	483,918	347,038	321,211	262,953	222,656	191,428	185,305
1998	499,520	358,227	331,567	271,430	229,835	197,600	191,279
1999	515,607	369,764	342,245	280,172	237,237	203,963	197,439
2000	532,193	381,658	353,254	289,184	244,868	210,524	203,790
2001	549,293	393,921	364,604	298,476	252,736	217,289	210,338
2002	565,312	405,409	375,238	307,180	260,106	223,626	216,473
2003	581,754	417,200	386,151	316,115	267,671	230,130	222,769
2004	598,626	429,300	397,350	325,282	275,434	236,804	229,229
2005	615,937	441,714	408,841	334,689	283,399	243,652	235,858
2006	633,695	454,449	420,628	344,339	291,570	250,677	242,658
2007	651,911	467,512	432,719	354,237	299,951	257,882	249,633
2008	670,592	480,910	445,119	364,388	308,547	265,272	256,787
2009	689,748	494,647	457,835	374,797	317,361	272,850	264,122
2010	709,389	508,733	470,872	385,469	326,398	280,620	271,643
2011	729,522	523,171	484,236	396,409	335,661	288,584	279,353
2012	734,507	526,746	487,544	399,118	337,955	290,556	281,262
2013	739,456	530,295	490,829	401,807	340,232	292,513	283,157
2014	744,543	533,943	494,206	404,571	342,572	294,526	285,105
2015	749,595	537,566	497,559	407,316	344,897	296,524	287,039
Total	12,463,908	8,938,390	8,273,176	6,772,663	5,734,781	4,930,463	4,772,752

(1) Refer to Table N-17 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

Table N-26
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in Peel Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed Systems (2) (60% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	598,695	429,349	397,396	325,320	275,466	236,831	229,256
1997	611,371	438,440	405,810	332,208	281,299	241,846	234,110
1998	624,295	447,708	414,389	339,231	287,245	246,958	239,059
1999	637,469	457,156	423,133	346,389	293,306	252,169	244,103
2000	650,897	466,786	432,046	353,686	299,485	257,481	249,245
2001	664,590	476,605	441,135	361,126	305,785	262,898	254,489
2002	677,638	485,962	449,796	368,216	311,789	268,059	259,485
2003	690,900	495,473	458,599	375,423	317,891	273,306	264,563
2004	704,393	505,150	467,556	382,755	324,099	278,643	269,730
2005	718,102	514,981	476,655	390,204	330,407	284,066	274,980
2006	732,037	524,974	485,904	397,776	336,818	289,578	280,316
2007	746,198	535,130	495,304	405,471	343,334	295,180	285,739
2008	760,588	545,449	504,856	413,290	349,955	300,873	291,249
2009	775,209	555,935	514,561	421,235	356,682	306,657	296,848
2010	790,062	566,587	524,420	429,306	363,516	312,532	302,535
2011	805,150	577,407	534,435	437,504	370,458	318,501	308,313
2012	807,514	579,102	536,004	438,789	371,546	319,436	309,218
2013	809,835	580,767	537,545	440,050	372,614	320,354	310,107
2014	812,108	582,397	539,054	441,285	373,660	321,253	310,977
2015	814,335	583,994	540,532	442,495	374,684	322,134	311,830
Total	14,431,387	10,349,352	9,579,131	7,841,756	6,640,040	5,708,757	5,526,150

(1) Refer to Table N-18 for derivation of net IC&I waste generation.
(2) Assuming 60% coverage by 3Rs Regulations (refer to Service Technical Appendix, Section 12.4 for detailed explanation.)

SCHEDULE O

INFORMATION ON CURRENT IC&I WASTE DIVERSION ACTIVITIES

SCHEDULE O-1 — GENERAL OVERVIEW OF PRIVATE SECTOR HAULERS AND RECYCLERS IN GTA

Management of IC&I waste in the GTA is carried out mostly by private sector haulers, recyclers, brokers and processors, and material is sold to end markets both within and outside the GTA. An overview of the industries which provide IC&I waste management services is presented below.

Note that a large majority of the waste haulers in the GTA are able to provide some sort of recycling collection service for their customers.

Waste Haulers

The waste hauling industry in the GTA can be divided into 3 categories by company size, level and location of service. The range of materials collected by recycling companies that service the GTA IC&I sector primarily include: OCC, mixed office paper, metal food and beverage cans, glass bottles, plastics (rigid and flexible), and wood waste.

Large Companies

The largest group of haulers operating in the GTA represent three of the largest multi-national waste hauling companies in North America. Waste Management Inc. (WMI), Browning-Ferris Industries (BFI) and Laidlaw Waste Systems are the most dominant haulers in the GTA. Each of these companies provides a wide-range of waste collection services to the IC&I sector. These services include:

- *containerized service* – provision of 20, 30 and 40 cubic yard (cy) containers and compactors (if requested) to customers. Containers are collected by a dedicated truck which services one container at a time;
- *front-end loader service* – provision of containers from 2 to 10 cy capacity and compactors (if requested) which are serviced with a front-end loader truck. The truck can collect from up to 30 accounts before becoming filled;
- *rear-packer service* – provision of collection service to customers using a rear packer truck. The truck collects from customers who do not have the space, accessibility or volume of waste to effectively use a container. Waste is manually loaded into the truck

Both Laidlaw and BFI provide recycling programs promoting source separation. Recycling containers (e.g. roll-out carts) are provided to customers for in-house collection of recyclables. These containers are then collected by the hauler on a regular or call basis. The hauler collects the recyclables with a separate truck and usually charges the customer a monthly or per pickup fee.

WMI operates a different type of program that does not require extensive source separation. The customer is asked to separate waste into dry (e.g. paper, OCC, glass, cans, plastics etc.) and wet (e.g. food and bathroom) waste. WMI collects the materials separately using conventional garbage collection equipment. The wet fraction is sent for disposal and the dry fraction used to be sent to the Recycle Canada (WMI's recycling company) facility in Etobicoke where the recyclables were mechanically and manually recovered for recycling. The facility closed in late 1993.

These companies tend not to service the construction, renovation and demolition industry. Materials are usually taken for processing in a private MRF, except in the case of high volume

materials such as wood and OCC. These high volume materials are collected in containers provided by the hauler and taken directly to a processor or end market.

Middle Level Companies

The second level of waste haulers can best be described as regional haulers that provide a similar level of service, but individually do not have the same customer base. Also included are large recycling companies that specialize in one type of material. The haulers tend to provide a multi-material service, similar to Laidlaw or BFI, whereas the large recycling companies tend to handle a more limited number of materials that are associated with their business interests.

This second level of haulers number between 10 and 20 companies and have the ability (i.e. equipment) to provide a range of collection services to clients such as containerized, front-end loader and rear-packer services. Examples of these types of companies include: Philips Environmental, Miller Waste Systems, L.W. Sanderson, York Disposal, Wasteco, Pak-Man/Tower Disposal, Select Disposal Services, Canadian Disposal Services and U-Pak Disposal. Examples of the large recycling companies in this category include Domtar, Atlantic Packaging, Alcan Recycling, and large scrap metal companies such as Triple M Metals.

These companies tend to work on a more regional basis, but usually have clients in a number of GTA municipalities. For example, Miller is heavily involved in York and Durham regions, while Sanderson is more focused in Peel and Halton.

Third Level Companies

Third level companies are characterized by being smaller and independent, with a more limited level of service and customer base. They provide a range of services that may handle a wide range of recyclables but exclude regular garbage. These companies tend only to provide containerized services to heavy industrial, large commercial (require container and/or compactor) accounts, and are very active in the construction, renovation and demolition industry.

Some examples of these types of companies include Cougar Disposal, Romano Disposal, J&F Disposal, Cardinal Waste, Via Disposal, R&R Haulage, Metro Waste Paper, Turtle Island, Enviro-Glass, The Paper Option, HGC Management, AAA Recycling and Office Waste Management.

Profile of GTA Recycling Companies

There are over 220 private sector companies providing a range of hauling, processing and marketing services for IC&I wastes in GTA. A complete listing of all IC&I recycling companies in GTA is available through the Recycling Council of Ontario. A profile of the number of companies covering the range of IC&I waste materials is provided in Table O-1.1 (RCO, 1992). Table O-1.3 at the end of this section summarizes available data on IC&I haulers and recyclers operating in the GTA (RCO, 1993).

Description of a Selection IC&I Processing Facilities in GTA

A description of all of the processing facilities in GTA is not included in this report. A number of facilities are described however, to illustrate the size and range of facilities in existence. These are organized by the materials handled. A selection of IC&I processing facilities in GTA is presented in the brief description below.

Table O-1.1

Estimated Number of GTA Recycling Companies Involved in Management of Different Materials, 1992

Material	Number of GTA Companies that Haul, Process, Market the Material*
Asphalt and Concrete	21
Construction & Demolition	19
Drum Reconditioning	10
Drywall	24
Food & Beverage Cans	31
Food & Organic Waste	20
Glass	22
Scrap Metal Recovery	57
Paper Products	89
Plastics	68
Social Service Organizations	9
Textiles	9
Tires	18
Wood	63

*Note: the number of services shown adds to greater than the total of 220 because several companies provide multiple services.

Source: Recycling Council of Ontario, *Secondary Material Markets Directory*, 1992.

Food Wastes:

Barrets Pig Farm is located in Brooklin. This farm has capacity to receive up to 4,000 tonnes food and organic waste annually.

Hy Hope Farms is a hog farming operation which utilizes food waste from restaurant, hotels and cafeterias as a food source. The facility's stated capacity is 1,200 tonnes.

Scott's Composting Farm in Milton, Ontario has been in operation since January 1991 (though temporarily closed in 1993). The site accepts commercial organics (i.e. food waste), wood, brush, leaves and grass clippings, low grade paper and corrugated, and miscellaneous materials such as tobacco fines and gypsum board paper. The site is an open air windrow operation. It currently handles about 40 tonnes per day and is permitted to accept a total of 20,000 tonnes per year (John Bremner, CMA site manager, May 3).

Construction and Demolition Wastes:

Elirpa Construction Materials operates a concrete crushing operation in Pickering. The facility has an estimated capacity of 100,000 tonnes of concrete waste annually.

Hamden & King Construction is a construction waste facility that has capacity to receive up to 14,000 tonnes of asphalt and concrete per year. It is located in Brooklin.

Bennet Paving in Oshawa is a manufacturer of asphalt paving which had a stated capacity of 35,000 tonnes of concrete waste to be mixed with 25,000 tonnes of reclaimed asphalt in 1992.

Drywall Scrap Co. is a depot accepting scrap drywall, located in Oshawa. It has capacity to receive up to 2,400 tonnes annually.

Queensway Recycling is a new facility located in Etobicoke. A joint venture between Cardinal Waste and Teperman Demolition, the facility receives C&D and IC&I wastes and recovers mixed office paper, OCC, wood and drywall and metals.

Harkow Aggregates and Recycling is located in the Toronto harbourfront area. Harkow operates a C&D processing and transfer operation with an operating capacity of 150,000 tonnes per year. The company manually separates wood, metals and OCC to achieve a 7% to 15% diversion of materials accepted. Harkow hope to construct a state-of-the-art facility which will mechanically process C&D waste. The start-up date is October 1994.

Conwaste operates a C&D and IC&I waste processing and transfer operation in Mississauga. Through manual separation, wood waste and OCC are recovered and sent to markets. The facility handles approximately 50,000 tonnes of materials per year.

Teperman operates a processing facility for their own demolition wastes. Brick and concrete, wood and metals are separated manually and with front-end loaders.

Canadian Eagle Recyclers is located in Markham. Canadian Eagle is affiliated with Greenspoon Demolition and operates a mixed C&D processing and transfer operation. Manual separation is utilized to recover wood, drywall, metals, OCC and used carpet materials. Canadian Eagle further processes wood waste on-site. The operation has an operating capacity of approximately 75,000 tonnes per year.

Several paving manufacturing operations utilize reclaimed asphalt and concrete wastes in the production of new asphalt paving. Two examples of these include **Fermar Asphalt** in Etobicoke and **Warren Bitulithic** in Downsview.

Traditional IC&I Recyclables (Cans, Bottles, OCC, Office Papers, etc.)

Courtesy Transfer operates a transfer operation for IC&I wastes where selected materials such as OCC, wood, plastics and other papers are removed prior to transfer. The Mississauga facility has an estimated capacity of 130,000 tonnes per year.

Harrison Disposal operates a waste transfer and sorting operation in Brampton which has a capacity of 15,000 tonnes per year. The facility handles mixed IC&I recyclables. Most of the material handled by the facility is likely to have been generated in Peel Region.

L.W. Sanderson operates a waste transfer and sorting operation in Brampton which has an estimated annual capacity of 100,000 tonnes of dry IC&I recyclables and residential Blue Box materials.

Waste Management of Canada Inc. operated a mixed waste sorting and transfer operation in Etobicoke. This facility began operation in 1991 to process select, source separated IC&I recyclables (OCC, wood, mixed papers, metals, glass and plastics) primarily from WMI customers (although the facility was open to other haulers who are able to provide the same quality of material). The facility had the ability to process 400 tonnes/day of mixed waste and was limited to a daily residue quantity of 200 tonnes. Diversion of incoming waste was estimated at 50% - 55% in 1993. The facility was closed in late 1993.

Laidlaw operates a large MRF in Mississauga which processes all the material collected from the municipal curbside and apartment recycling programs in Mississauga and Brampton. In addition, materials from the approximately 2,000 IC&I locations that are recycling in the GTA are processed at the MRF. The materials handled include mixed paper, OCC, metal cans, glass and polystyrene. The facility currently handles approximately 28,000 tonnes/yr of municipal material, and 12,000 tonnes/yr. of IC&I material. Laidlaw is constructing a new MRF/transfer station on the same site with a capacity of 200 tonnes/yr.

Miller Waste Systems operates a large operation in Markham which includes an IC&I processing facility, with the ability to handle wood waste, drywall, concrete and asphalt waste. Miller lists materials accepted in Metro's market directory as OCC, ONP, mixed office paper, metal cans, glass and most plastics.

Browning-Ferris Industries (BFI) operates a MRF in Concord for IC&I customers. BFI declined to provide additional information, however, BFI lists in the Metro Toronto Markets Directory under materials handled OCC, mixed office paper, beverage cans, glass and wood.

Prowaste, in cooperation with Browning-Ferris Industries (BFI), operate an IC&I MRF in Mississauga. The facility has an estimated capacity of 50,000 tonnes, and handles OCC, office paper and wood wastes.

The Recycler Inc. operates a sorting and processing operation for IC&I recyclables such as mixed office paper, metal cans and glass. The facility is located in Concord.

Waste Papers:

Domtar operates a paper fibre sorting and processing operation in Etobicoke. The facility receives primarily OCC and office papers from haulers and paper generators. The papers are sorted by grade and baled for shipping to Domtar facilities and other markets. The facility capacity is estimated to be 75,000 tonnes of paper fibres. Domtar also operates a

liner board manufacturing facility in Brampton which utilizes OCC in the manufacture of new cardboard containers.

Metro Waste Paper operates a sorting and processing operation in Scarborough which handles all grades of paper, metal cans, glass bottles and pallets.

Turtle Island services the IC&I sector and collects mixed office paper, metal cans and glass. It operates a small sorting and processing operation in Etobicoke.

Specialized Wastes:

Thermal Waste Reduction (TWR) operates a facility in Scarborough which operates a thermal screw press. The machinery has been used for a number of applications including the processing of wood waste and tires.

Lennox Drum Ltd. is a drum reconditioning facility that has capacity to receive up to 10,400 tonnes of steel and plastic drums annually. It is located in Ajax.

National Rubber Co. has been using recycled tires in the manufacture of various rubber products since 1927. In 1992, the company consumed approximately 22,500 tonnes of tires. National Rubber is expanding their operations to handle a total of 45,000 tonnes of tires from Ontario by 1997.

Alcan Recycling operates a processing operation in Brampton which handles primarily aluminum cans collected through the Brewers' Retail (BRI) and municipal curbside collection programs. Alcan also handles and processes glass and cans collected from IC&I customers, plastics from the BRI and other packaged beverages.

Wood Conversions Inc. (WCI) is a wood processing operation located in Brampton. The facility receives mixed and clean loads of wood waste and processes the wood through a series of chippers and screens to produce a consistent sized wood chip. The facility has an estimated capacity of 23,000 tonnes of wood waste per year. Most of the material handled by the facility is likely to have been generated in Peel Region.

The Canadian Polystyrene Recycling Association (CPRA) operates a sorting and processing facility in Mississauga. The facility receives polystyrene from large generators (e.g. automotive manufacturers), haulers and municipalities for processing and eventual sale to plastic manufacturers. The estimated annual capacity is 25,000 tonnes per year. In 1992, the facility processed 864 tonnes from the IC&I sector, including 186 tonnes of foam and rigid plastics from food service establishments. (*Recycled Plastics Update*, 1992).

Knowaste Technologies has recently established a facility in Mississauga that processes used diapers and sanitary napkins from hospitals and nursing homes.

IKO Industries in Brampton use wood waste and OCC in the manufacture of roof felt and shingles. The facility has expanded capacity to handle 30,000 tonnes of wood waste in 1993.

Westroc is a drywall manufacturer which purchases recycled gypsum from New West Gypsum in Oakville. The recycled gypsum is used in the manufacture of new drywall sheeting.

Waste Exchange, and Reuse,

Various facilities provided exchange services (e.g. Ontario Waste Exchange, local waste exchange program in Durham, the Re-Uze Centre, Scarborough, WASTEWISE, Halton, etc.)

The Ontario Waste Exchange (OWE) assists waste generators to identify markets for their waste materials. In 1992, OWE handled approximately 56,000 tonnes of materials. The proportion of these generated by GTA companies is not known. Since start-up in 1987, OWE has handled a total of roughly 222,000 tonnes of waste materials in the Province of Ontario (OWE, 1993).

Survey of Recycling Companies

A representative number (approximately 60 of the 220) of companies providing a range of hauling, processing and marketing services in GTA were selected for a survey to determine quantities of material handled in 1992 (the survey questionnaire and covering letter from MOEE are included at the end of this Section). Of the 60 target companies 54 companies were reached, and 37 participated. Most private haulers and recyclers contacted were unwilling to divulge proprietary information concerning their operations and capacities, however, indications of recycling activity for some materials were provided. Information was obtained from two of the largest companies, 5 middle-level and 30 small hauling and recycling companies.

Of the 54 companies contacted, 28 companies provided data on the tonnages of materials diverted in 1992. The 28 responding companies diverted an estimated 633,000 tonnes of waste in GTA in 1992. A similar number provided information on the number of IC&I accounts handled in 1992. The total number of accounts handled by approximately 28 responding companies was roughly 14,000. Of the 54 companies contacted, 31 reported employing 860 people. Table O-1.2 summarizes these results.

References

Information on 3Rs Facilities in the GTA, Table received from MOEE, June 10, 1993.

Memo to RIS from MOEE, *Additional Information from WRO*, February 15, 1994.

Ontario Recycling Resourcebook, Secondary Material Markets Directory, Recycling Council of Ontario, Published by Southam Information and Technology Group, 1993.

Ontario Waste Exchange, 1993, personal communication with Mary Jane Hanley, March, 1993.

Recycling Council of Ontario, *Secondary Material Markets Directory*, 1992

Resource Recycling, "PS Recycling News", *Recycled Plastics Update,* June 1992

Table O-1.2
Summary of the Results from
Survey of Recyclers/Haulers in GTA
May - July, 1993

No. Company	No. Accts	Tonnes/yr	No. Empl	No. Vehic	Tonnes/acct	tonnes/empl
1	20	2,231	28	0	112	80
2	1000	18,500	15	7	19	1233
3	75	43,600	7	7	581	6229
4	20	460			23	0
5	18	3,000			167	0
6			10	3	0	0
7	400	2,400	7	2	6	343
8		100			0	0
9	2,500	9,600	22	4	4	436
10	50	109,000	33	3	2180	3303
11	200	7,300	25	4	37	292
12	8	12,000	3	3	1500	4000
13	100	4,500	1	0	45	4500
14	500	33,000	50	6	66	660
15	200	130,000	25	20	650	5200
16			7	4	0	0
17	120	100	3	1	1	33
18					0	0
19	80	130	1	1	2	130
20	20	1,800	10	3	90	180
21	20	900	2	1	45	450
22	60		6		0	0
23	5,000		200	10	0	0
24	1,300	119,500	149	16	92	802
25	150	33,000	30	5	220	1100
26	30	1,500	6	2	50	250
27					0	0
28	35		13	5	0	0
29		15,000	35		0	429
30	200	180	30	12	1	6
31	300	140	3	2	0	47
32	250	2,000	12	3	8	167
33		62,500	65		0	962
34					0	0
35	150	2,000	1	3	13	2000
36	120	15,300	45	10	128	340
37	800	3,400	16	4	4	213
Total	13,726	633,141	860	141	46	736

Notes:

1. One company surveyed collects 25,000 old batteries
2. One company surveyed handles 110-130,000 pallets/yr
3. It was not always clarified whether quantities referred to tonnes (Metric) or tons (Imperial). When not clear - reported quantities were assumed to be Imperial tons.
4. Companies 18,27 and 34 provided information not shown in table.

Table O-1.3
IC&I Processing Services and Facilities in GTA

No.	Company Name	Business Type	Materials	Reference
1	Able Services	Hauler; Processor: Broker: End-user; Consultants	Clean fill; all grades of paper; metals; plastics; all wood; OCC; organics; lead acid batteries; clear and coloured glass; rubber; tires	1
2	Achievor Tire Ltd.	Processor; Hauler	Passenger & truck tires; agricultural; off-road; industrial solid; rubber products	1
3	Adanac Computer Supplies & Accessories	Processor	Laser jet cartridges; fabric ribbons	1
4	Aimco Solrec Ltd.	Broker; Hauler; Processor; Importer/Exporter	Liquid wastes; paints; solvents; inks; paint sludges	1
5	Al's Waste Control Inc.	Transfer; Processor; some recycling	commercial and industrial solid non-hazardous waste	3
6	Albis Canada Inc.	Broker; Importer/Exporter; Compounder	ABS; PC; PS; PP; SAN; TPR; TPO; PE; nylon; metal and steel cans; OCC; steel drums; lab solvents; glass bottles	1
7	Alcan Recycling, A Division of Alcan Aluminum Ltd.	Processor	Aluminum cans; glass containers; aluminum foil; aluminum bottle caps; OCC; boxboard	1
8	All-Type Containers Ltd.	Hauler; Processor	New and used reusable corrugated cardboard cartons which are off-spec	1
9	Almac Products and Union Felt Products	Hauler; Processor	Assorted textiles	1
10	Alternative Recycling Services Ltd.	Hauler; Processor	Mixed office paper; OCC; ONP; pop cans; beverage bottles; wood skids	1
11	AMP Waste Systems Inc.	Processors; Haulers	C & D debris: OCC; drywall; wood; metal	1
12	Anachemia Solvents Ltd.	Hauler; Processor	Solvents; liquid waste; lubricating and motor oil	1
13	Andrew's Scenic Acres	End-user	Clean sawdust, wood shavings, woodchips, chipped Christmas trees	1
14	Arch Industries	Processor; Broker; Importer/Exporter; End-user	All forms of textile waste; paper	1

No.	Company Name	Business Type	Materials	Reference
15	Ardee Recycling Inc.	Broker; Hauler; Processor	Oil Filters	1
16	Associated Metal Products	Hauler; Processor	Industrial ferrous and non-ferrous metals; white goods	1
17	Atlantic Packaging Products Ltd.	Hauler; Processor	OCC: ONP; plastic bags; baled kraft bags; coated book stock; assorted white ledger; black and white ledger; HDPE bags, OMG	1
18	Automation Services	Hauler; Processor	Fabric printer ribbons; toner cartridges and toners	1
19	B & M Metal Recycling	Hauler; Processor	Ferrous and non-ferrous metals; automotive batteries	1
20	Banner Rendering Ltd.	Hauler; Processor	Bones, fat, grain processing and milling by-products	1
21	Barrett's Pig Farm		Food and organic scraps	1
22	Beginners Computers	Processor	Computer equipment; electronic office equipment; technical books and manuals; electronic magazines	1
23	Bennett Paving and Materials Ltd.	Processor	Asphalt and concrete	1
24	Bergman Barrel and Drum Co. Ltd.	Hauler; Processor	Metal and plastic drums	1
25	BFI Waste Systems	Hauler; Processor	Drywall; clear and coloured glass; cans; scrap metal; OCC; ONP; fine paper; HDPE; plastic wrap; pallets; skids; wood waste	1
26	Blue Disposal	Processor	Commercial and solid non-hazardous waste	3
27	Bradex Industrial Services Ltd.	Hauler; Processor	Plastic scrap: PP, PE, PS, ABS, PVC; also plastic products and additives	1
28	Bronte 3R's	Hauler; Processor	OCC; boxboard; metal cans; glass; fine paper; ONP; magazines; telephone books; scrap metal; plastics	1
29	Bruce Smith Disposal Service	Hauler; Processor	OCC	1
30	CNC (York Region)	MRF - fine paper	Fine paper and OCC	2
31	Calder Recycling Systems	Broker; Consultant; End-user; Exporter/Importer; Hauler; Processor	LDPE; HDPE; HIPS; PC; PVC; ABS; PP; plastic film scrap including plastic bags; OCC; fine paper; all wood	1

No.	Company Name	Business Type	Materials	Reference
32	Canada CRINC Ltd.	Processor	Clear, green and brown glass; aluminum and steel beverage and food cans; PET; HDPE	1
33	Canada Compost	In-vessel composting facility	IC&I food waste	2
34	Canada Iron and Metal Co. Ltd.	Processor	Ferrous and non-ferrous metals; batteries	1
35	The Canada Metal Co. Ltd.	Processor	Automotive batteries; scrap lead; lead residues; tin alloys; industrial batteries	1
36	Canadian Eagle Recyclers Inc.	Hauler; Processor; Recycler and transfer station	Clean wood (pallets, crates included); C&D debris (drywall, brick, reinforced concrete); metals; clean asphalt and asphalt shingles; white goods; carpeting; all roofing materials including flatdeck	1
37	Canadian Foundation for World Development	End-user; Processor	Any material or equipment which will benefit 3rd world countries	1
38	Canadian Laser Products Inc.	Processor	Laser printer cartridges	1
39	Canadian Polystyrene Recycling Association	Hauler, Processor	Polystyrene	1
40	Canadian Ribbon Rollers, Inc.	Hauler; Processor; End-user	Laser and photocopier toner cartridges; computer printer ribbons	1
41	Canadian Textile Recycling Ltd.	End-user; Processor; Consultant; Importer/Exporter; Broker	Clothing; new and used textile cuttings; rolled textile; work clothes; fibre and thread wastes; shoes; handbags; belts	1
42	Capital Paving	End-user; Processor	Foundry sand; concrete and asphalt rubble; reclaimed asphalt pavement; other granular materials	1
43	Carti Save	End-user; Hauler; Processor	Laser toner cartridges; Canon PC toner cartridges; fax cartridges	1
44	Chane Marketing Inc.	Processor	PP; PET; LLDPE and LDPE	1
45	Chem Ecol Ltd.	Processor; Hauler	All industrial oil	1
46	Chep Canada Inc.	Hauler; Processor	CHEP pallets (their own pallets)	1
47	Cherrymill Iron and Metal Co.	Hauler; Processor	Cast iron, steel, aluminum, stainless steel, copper, brass, insulated electrical wire, electric motors; white goods; negative film; car and truck batteries	1

No.	Company Name	Business Type	Materials	Reference
48	City Forest	Consultant; Hauler; Processor	All paper grades	1
49	Climatizer Insulation	Processor	ONP; OCC	1
50	Co-Steel Lasco	Broker; End-user; Hauler; Processor	Scrap, ferrous metals except cast iron	1
51	Colantonio Metals Ltd.	Hauler; Processor	Ferrous and non-ferrous metals; aluminum, brass, copper, zinc, lead, insulated cable	1
52	Combine Disposal Services	Hauler; Processor	OCC	1
53	Command Record Services	Hauler; Processor	Computer printout (CPO); general paper records from business; fine paper	1
54	Compressed Metals	Broker; Importer/Exporter; Processor; Consultant	Ferrous and non-ferrous scrap metals; computer and electronic scrap; circuit boards; plugs and telephone relays	1
55	Computer Ribbon Rescue	Hauler; Processor	Laser toner cartridges; fabric printer ribbons; PC computer equipment	1
56	Confidential Recycling Service Ltd.	Broker; Processor	Fine paper; ONP; OCC; mixed paper; metal cans (aluminum and pop cans); glass containers	1
57	Conros Corporation	End-user	Hardwood sawdust and woodchips	1
58	Consumers Glass	End-user; Processor	Glass containers	1
59	Continental Paper Grading of Canada Inc.	Broker; Importer/Exporter; Processor	OCC; office paper; ONP; books	1
60	Conwaste Inc.	Hauler; Processor	All solid, non-hazardous waste	1
61	Cooper's Iron and Metal Inc.	Hauler; Processor	Ferrous and non-ferrous metals	1
62	Copy Charge Ent.	Processor; End-user	Laser toner cartridges	1
63	Corundol Environmental Ltd.	Processor	Motor and hydraulic oil; oily water; acids and alkalis	1
64	Courtesy Transfer	Transfer, processor	Dry ICI: OCC, wood, paper, plastic	2
65	Crown Metals	Hauler; Processor; Consultant; Broker; Importer/Exporter	Aluminum, stainless steel, copper; brass; steel	1
66	D. Crupi and Sons Ltd.	Processor	Broker asphalt and concrete	1
67	D.E.L. Discount	Processor	Off-specification items/materials; wood pallets	1
68	Daily Bread Food Bank	End-user	Non-perishable edible food items	1
69	Desbro Polymers (Canada) Ltd.	Processor	Post-consumer HDPE	1
70	Direct Disposal	Processor; Recycler	Drywall, aluminum, metals, cardboard	3

No.	Company Name	Business Type	Materials	Reference
71	Dominion Fibre Containers Canada	Processor	Fibre drums	1
72	Domtar Packaging - Recycling	Broker; Hauler; Processor; Consultant; End-user; Exporter/Importer	OCC (other paper grades too?)	1
73	Durham Recycling Centre	Processor	Residential and commercial Blue Box, cardboard and fine paper	2
74	Easy-Pack Corporation	Hauler; Processor	Loose-fill PS; reusable OCC containers	1
75	Eco-Mat Environmental Restoration Inc.	End-user; Processor	Asphalt; concrete; drywall; brick; shingles; wood	1
76	Eco-Rez Enterprises	Processor	Laser toner cartridges; ribbons	1
77	Eco-Tank	Hauler; Processor; End-User; Broker	All size propane tanks	1
78	Eco-Wood Products	Hauler; Processor; Consultant	Scrap wood; used pallets; skids; sawdust; crates and spools (any size); ONP; OCC; boxboard; waxboard	1
79	Ecopal Canada Inc.	Processor	HDPE	1
80	Elirpa Construction Materials Ltd.	Processor	Concrete and asphalt	1
81	Envirogard Shredding & Disposal	Hauler; Processor	Most grades of paper (excluding ONP)	1
82	Enviro-Glass Recycling Inc.	Hauler; Processor	PS; glass containers; aluminum cans; steel cans; ONP; organic waste; all types of paper	1
83	Envirotech Recycling Systems	Broker; Processor	Glass; fine paper; OCC; ONP; primary cell batteries from IC&I (no auto batteries); post industrial plastics (HDPE, LDPE, ABS, PET, EVA, HIPS)	1
84	Envision Recycling	Broker; Consultant; Processor	Principal resins, LDPE and HDPE films	1
85	Ewid Ltd.	Processor	Rubber	1
86	Exalloy Metals Inc.	Processor; End-user	Plastic laminated aluminum foils; bare and lacquered aluminum foil	1
87	Extredz	Processor	Off road vehicle inner tubes; truck inner tubes; farm inner tubes	1
88	Fabricated Plastics Ltd. (FABCO)	Processor	Plastic scrap	1
89	Fermar Asphalt Ltd.	Processor	Asphalt and concrete	1

No.	Company Name	Business Type	Materials	Reference
90	Fibre Management Group	Broker; Hauler; Consultant; Importer/Exporter; End-user; Processor	Fine paper; OCC; ONP; CPO; kraft; boxboard; magazines; phone books; envelopes; glossy paper; window envelopes	1
91	Fibre Resource Recovery Corp.	Broker; Hauler; Importer/Exporter; Processor	Fine paper; kraft; OCC; ONP; CPO; boxboard; magazines; phone books; envelopes; glossy paper; all recyclable paper products	1
92	Fluid Management Services Inc.	Hauler; Processor	Industrial oils and other liquid wastes; solvents; cutting fluids and washes	1
93	Foodpath	Hauler; Foodbank	Perishable (some) and non-perishable food; off-spec personal care items, etc.	1
94	Frank Wills, Hog Farmer	End-user	Food and some organic materials/scraps, including dairy and bakery by-products	1
95	Full Recovery Recyclers Inc.	Hauler; End-user	Food waste; sawdust	
96	Fully Integrated Recycling Systems	Processor	Most plastics	1
97	G & G Recycling	MRF - fine paper	Fine paper; OCC	2
98	G & R Automotive Machine Shop	Broker; Hauler; Processor	Ferrous and non-ferrous metals; oil; antifreeze; freon; motor vehicle batteries	1
99	Galvan Plastics	Broker; Hauler; Processor	PP; LDPE; HDPE; PE; LLDPE; PS; ABS; industrial waste	1
100	Genor Recycling Services Ltd.	Broker; Consultant; Importer/Exporter; Hauler; Processor	Boxboard; OCC; fine paper; ONP; aluminum and steel cans; PET; mixed rigid plastics; phone books; kraft paper; all grad of paper; assorted glass containers	1
101	Goodwill Industries of Toronto	Hauler; Processor; Retailer	Clothing; books; small appliances; furniture, etc.	1
102	Graham Brothers Construction	Processor	Asphalt, concrete and clean fill	1
103	The Grease Man	Hauler; Processor; End-user	Waste grease	1
104	The Green Office	Hauler; Processor	Food and beverage bottles and jars; food and beverage cans; computer printouts; mixed office paper; ONP; magazines; phone books; HDPE; PET; PS	1

No.	Company Name	Business Type	Materials	Reference
105	Grow Rich Inc.	End-user	Sawdust and wood chips; food (processing) and other organic materials; manures; paper mill and industrial sludges; OCC	1
106	H. Heller & Co. Inc.	Broker; Processor; Importer/Exporter	HDPE; LDPE; PP; PS; vinyl; PET	1
107	H. Salb International	End-user; Importer/Exporter; Processor	Used clothing; cotton and synthetic textiles	1
108	Handy and Harman of Canada Ltd.	End-user; Processor	All precious metals	1
109	Hanna Paper Fibres Ltd.	Hauler; Processor	Fine paper; books	1
110	Harkow Aggregates and Recycling	Processor	Ferrous and non-ferrous metals; OCC; tires; pallets and most wood; all non-hazardous mixed IC&I and C&D waste, including drywall and vinyl drywall; concrete	1
111	Harrison Disposal	Broker; Processor	All types	1
112	Hevmet Recovery	Processor; Recycling	Copper; nickel; zinc	1
113	HGC Management Inc.	Hauler; Processor; Consultant; Broker	Fine paper; boxboard; ONP; OCC; glass containers; PET; HDPE; PS; plastic film; food and beverage cans	1
114	High Park Scrap Metals	Hauler; Processor	Ferrous and non-ferrous metals	1
115	Hi-Tech Cleaners	Processor	Laser toner cartridges	1
116	Hy-Hope Farm	End-user; Processor	Food waste	1
117	I.G. Machine & Fibres	End-user	OCC, wood chips, ONP, office and mixed paper	1
118	Industrial Chemical Refiners	Processor; Hauler	All chlorinated solvents and freon	1
119	Ianco Enviro Tech Inc.	Processor; Consultant	HDPE; ABS; PP	1
120	Industrial Chemical Refiners	Processor; Hauler	All chlorinated solvents and freon	1
121	Innovative New Ideas (I.N.I)	Processor	Toner cartridges; computers	1
122	Intermetco Ltd.	Hauler; Processor	Ferrous and non-ferrous metals; white goods	1
123	International Business Supplies (IBS)	Processor	Magnetic recording media; computer tape; VHS/Beta tapes; diskettes; data cartridges and cassettes; CD's; vinyl records	1

No.	Company Name	Business Type	Materials	Reference
124	I.W.&S. Ferrous Ltd.	Hauler; Processor; End-user; Broker; Importer/Exporter; Consultant	Asphalt for fill; car & industrial batteries; steel drums; ferrous and non-ferrous scrap metals; computer equipment	1
125	J & F Waste	Hauler; Processor	FP; mixed paper; ONP; glossy stock; organics; glass containers; aluminum cans; steel cans; OCC; clean fill; drywall; most plastics; tires; skids; wood	1
126	J.C. Waste Management 1990 Inc.	Broker; Consultant; Hauler; Processor	Boxboard; OCC; mixed paper; ONP	1
127	Jireh Recycling Services Ltd.	Processor	Uncontaminated wood waste	1
128	Joe's Recycling	Hauler; Processor; Consultant	Glass containers; aluminum cans; OCC; ONP; fine and mixed paper; PS; PVC; rigid polystyrene; organics (and kitchen grease); tires; wood; computer equipment; textiles	1
129	Jubil Materials Management Service	Processor	Wood pallets, products and skids, select scrap	1
130	K & K Plastics	Processor	PPT; acrylic; lexon; polycarbon; PVC	1
131	Kantal Metals	Hauler; Processor; Importer/Exporter	Non-ferrous and precious metals from electronic equipment (computers); telecommunications equipment; wires from industry	1
132	Kord Products Ltd.	Broker; Processor	ONP; waxed cup stock and other waxed non-corrugated cartons	1
133	Laidlaw Environmental Services Ltd.	Processor	Non-hazardous solid industrial waste; liquid industrial and hazardous waste	1
134	Laidlaw Waste Systems	Broker; Hauler; Importer/Exporter; Processor	Magazines (shredded and baled); #8 grade ONP (baled); all grades of paper; container glass; ferrous and non-ferrous metals; drywall; wood; OCC; PET; HDPE; PS; LDPE	1
135	Laser Cartridge Services Inc.	Processor; Hauler	All laser printer cartridges and PC copier toner cartridges	1
136	Laser Charge	End-user; Hauler; Processor	Laser toner cartridges	1
137	Laser Recharge Canada	Hauler; Processor; End-user	Laser printer cartridges and photo copier cartridges	1

No.	Company Name	Business Type	Materials	Reference
138	Laser Rechargers of Canada	Hauler; Processor	Laser toner cartridges; copier toner cartridges; laser printers and parts; photo copiers and parts	1
139	Laser Save	End-user; Hauler; Processor	Laser toner cartridges	1
140	LaserAge	End-user; Hauler; Processor	Laser toner cartridges	1
141	Laserfill Cartridge Corp.	Broker; Processor	Laser toner cartridges	1
142	Lasernetworks	Hauler; Processor; End-user	Laser toner cartridges	1
143	Lennox Drum Ltd.	Hauler; Processor; End-user	Steel and plastic drums and pails; large tote tanks	1
144	Luzza International Livestock Corp.	End-user	Wood shavings	1
145	L.W. Sanderson and Sons Cartage Ltd.	Hauler; Processor	Boxboard; OCC; ONP; fine paper; drywall; tires; cans; glass; metals including appliances; PS	1
146	MacLean Hunter Canadian Publishing	Processor	Magazines	1
147	Malecki Drum Inc.	Processor	Steel and plastic drums (HDPE)	1
148	Mammone Disposal	In-vessel composting facility	IC&I food and wood waste	2
149	Management Board Secretariat (located at Ontario Science Centre)	In-vessel composting facility	IC&I food waste	2
150	Maple Paving Products Ltd.	Processor	Asphalt and concrete	1
151	Maratek Environmental Inc.	Hauler; Processor	Printing and photographic waste chemicals; photographic films	1
152	Margold Industries	Broker; Processor	All non-ferrous and ferrous scrap metal; photographic film and chemical waste; lead and aluminum plates (printing industry); steel; copper; brass	1
153	Menunier Recyclables	Hauler; Processor	Lead; wire; aluminum; nickel; steel; brass; copper; bronze; stainless steel; boxboard; ONP; OCC; CPO; FP	1
154	Merchandise Recovery Services Inc.	Hauler; Processor; Exporter	White goods	1
155	Metal Recovery Industries Inc. (MRI)	Processor; Broker; End-user; Importer/Exporter; Consultant; Hauler	Steel and aluminum cans; metal sludges; steel beams; aluminum sheet; drums; all metals	1
156	Metro Salvage; Consolidated Recycling Inc.	Hauler; Processor; Consultant; Broker; Importer/Exporter	Ferrous and non-ferrous metals; batteries; clean and dry drums	1

No.	Company Name	Business Type	Materials	Reference
157	Metro Waste Paper Recovery	Consultant; Exporter/Importer; Hauler; Processor; Broker	Fine paper; mixed office paper; ONP; OCC; phone books; glass; metals; cans; food and organic materials; polystyrene and others; wooden pallets	1
158	The Metropolitan Toronto and Region Conservation Authority (MTRCA)	Processor	Clean concrete, asphalt and brick	1
159	Miller Waste Systems	Hauler; Processor	Clean concrete and rubble; clean drywall; OCC; clean wood; glass food and beverage containers; metal cans; plastics; ONP; mixed office paper; HDPE; LDPE; PE; PET; PS	1
160	Mississauga Paper Fibres	Broker; Consultant; End-user; Importer/Exporter; Hauler; Processor	High grade office waste paper; fine paper; printer's scrap; books	1
161	MKG Cartridge Refill Systems	Hauler; Processor	Toner cartridges	1
162	Mongke Resources Capital Ltd.	Processor; some recycling	Commercial and industrial solid non-hazardous waste processing	3
163	Mosaic Chemical Corp.	Processor	Waste oil; motor oil; oily water	1
164	Mr. Pallet Inc.	Processor	Used wood pallets and skids	1
165	National Rubber	Processor; End-user	Uncured rubber waste; tires; tire crumb and fabric	1
166	Neil R. Davis Farms Ltd.	Hauler	Dry waste food and organic materials (including dairy products); produce; wood shavings and sawdust	1
167	Newcastle Recycling Ltd.	Broker; Hauler; Processor	Ferrous and non-ferrous metals; used cars; car parts; batteries; drums	1
168	Newcastle Salvage	Hauler; Processor	Concrete, asphalt, rubble, clean fill, metal, wood, asphalt shingles, fuel storage tanks	1
169	Newmarket Iron and Metal Company Ltd.	Processor	Ferrous and non-ferrous metals, also scrap cars and trucks	1
170	New West Gypsum Ontario Inc.	Processor	Drywall; all types of vinylboard; painted board; wallboard not contaminated with lead	1
171	Nickel Cadmium Recycling	Processor	Nickel cadmium batteries	1

No.	Company Name	Business Type	Materials	Reference
172	Norjohn Transfer Systems	Processor; Hauler; Importer/Exporter	OCC; ONP; organics; steel and aluminum; drywall; all container glass; PET; tires; pallets and wood	1
173	Nu-Plast	Hauler; Processor	PS; ABS; PC; LDPE; MDPE; HDPE; PP	1
174	O.C. Liquid Waste Haulers of Ontario Ltd.	Hauler; Processor	Liquid and Solid wastes	1
175	O & E Farms Ltd.	Hauler; Processor; End-user	Liquid or solid food by-products including bakery waste, soups, produce, meats, canned dog food	1
176	Oak-Mississauga Cartons & Shipping Supplies Co. Ltd.	Hauler; Processor	OCC; FP; boxboard	1
177	OLPE Tyme Pallets Ltd.	Hauler; processor, end-user	Wood pallets; clean/uncontaminated wood	1
178	Ontario Sawdust Supply Ltd.	Hauler; Processor; End-user; Consultant; Broker	Softwood and hardwood sawdust; shavings and wood chips	1
179	Pacific Packaging Products Ltd.	Broker; Importer/Exporter; Hauler; Processor	Baled OCC; corrugated waste; office paper; hard & soft cover books	1
180	Paper Fibres Inc.	Broker; Consultant; Hauler; Importer/Exporter; Processor	Office records; printer's waste; CPO	1
181	Paramount Rubber Recycling Inc.	Hauler; Processor	Rubber; tires	1
182	Parma Plastics Inc.	Consultant; Processor	Flexible PVC	1
183	Peel Bio Conversion Inc.	In-vessel composting facility	IC&I food waste	
184	Peel Scrap Metal Recycling Ltd.	Processor	Ferrous and non-ferrous scrap metals	1
185	Petrex Waste Management Ltd.	Hauler; Processor	C&D debris; Blue Box recyclables; mixed steel; all aluminum including windows; wood; bathtubs; doors; clean reinforced concrete; clean loads of asphalt; clean fill; OCC	1
186	Philip Environmental Inc.	Hauler; Processor; Consultant; Broker; End-user	All materials	1
187	Phoenix Fiberglass Inc.	Processor; End-user	Fibreglass; cured thermoset reinforced plastic	1
188	Plast-Ex International Inc.	Hauler; Processor; Importer/Exporter	All plastics; foam reduction equipment	1
189	Plasticycle Inc.	Hauler; Processor	LDPE; LLDPE; HDPE; PE	1

No.	Company Name	Business Type	Materials	Reference
190	Polymart Inc.	Processor	HDPE; LDPE; ABS; PS; PC: PVC; PET; PP; Noryel	1
191	Posner Metals	Hauler; Broker; Importer/Exporter; Processor	Ferrous and non-ferrous scrap metal; lead acid batteries; drums; glass	1
192	Pre-Fab Cushion Products	Hauler; Processor	PE foam	1
193	Proshred Security	Hauler; Processor	All paper	1
194	Prowaste - BFI (Mississauga)	Processor	OCC, wood, fine paper	2
195	Queensway Recycling Corp.	Processor	Commercial and industrial solid non-hazardous waste	3
196	QUNO Recycling Corporation (Etobicoke)	Hauler; Broker; Processor	Boxboard; OCC; all grades of paper; ONP	1
197	QUNO Recycling Corporation (Toronto)	Broker; End-user; Processor	All grades paper; OCC; ONP; FP; aluminum and steel beverage/food cans; cores from paper rolls	1
198	R.T. Recycling Inc.	Processor	Wood	1
199	R12Cycles Computers and Office Centre	Processor	Computers; computer monitors; computer printers; fax machines; VCRs; stereos, etc.	1
200	Raylex Electrical Distributors	Processor; Importer/Exporter	Street and industrial lighting lamps	1
201	RCR International Inc.	Hauler; Processor	Flexible PVC only	1
202	Really Green Inc.	Processor	Pallet wood; any type of wood including cut-offs; heavy paper tubing	1
203	Reclamation Services	Hauler; Processor	Hydraulic oils; certain metal working lubes	1
204	Recovery Technologies Inc.	Broker; Consultant; Processor	Thermoplastics; thermoset plastic and rubber scrap including tires	1
205	Recycle Canada	Processor; Hauler	23--HDPE; 4-LDPE; PET; 6-PS; PVC; all grades of paper; OCC; ONP; glass; aluminum cans; steel cans; ferrous and non-ferrous sawdust; particle board	1
206	Recycle Trade Inc.	Hauler; Processor	Ferrous and non-ferrous metals	1
207	Recycle-It-Canada	Hauler; Processor	FP; mixed paper; OCC; pop cans; glass bottles	1

No.	Company Name	Business Type	Materials	Reference
208	The Recycler Inc.	Broker; Consultant; Hauler; Processor	Aluminum & steel cans; FP; ONP; all grades of paper; boxboard; OCC; magazines; glass containers; organic food waste; leaves and yard waste; general kitchen scraps; HDPE; HDPE film; LDPE' LDPE film; PS; PP; grease	1
209	Refrigerant Recovery Services	Broker; Processor	Freon; all types of refrigerant recovery	1
210	Regal Home Products Inc.	Processor; End-user	Flexible PVC only	1
211	Residue North	Processor	Cuttings from textile factories; mattress scrap ticking with foam; polyurethane foam scrap	1
212	Retzer Sawdust Services		Sawdust and shavings, any wood waste	1
213	The Reuse Centre	Re-seller	Household appliances; tools; building supplies; office equipment; office supplies; plumbing fixtures, etc.	1
214	Resource Plastics Corp.	Processor; importer/exporter	PP; HDPE; LDPE; LLPPE	1
215	Reuze Building Centre	Processor	Lumber; plywood; paneling; cabinets; windows; doors; floor coverings; plumbing fixtures and supplies; electrical fixtures and supplies; supplies; hardware	1
216	Roger Larue Enterprises Ltd.	Hauler; Processor	Clear and coloured glass; tin; aluminum; FP; OCC; ONP; CPO; boxboard; magazines; phone books; envelopes; glossy paper; kraft; PET	1
217	Rosen Industries Ltd.	Processor; broker; importer/exporter	Cullet; plate glass; scrap metals	1
218	Rubbertech Salvage Ltd.	Hauler; Processor; Importer/Exporter	Tires	1
219	Rotasay	Hauler; processor	Animal by-products; food waste; grease	1
220	S. Cronish and Son Ltd.	Hauler; Processor	Ferrous and non-ferrous metals	1
221	Safeguard Shredding Inc.	Processor	CPO; mixed paper	1
222	Safety & Kleen Canada Inc.	Hauler; processor, end-user	Waste oils; solvents; used glycel; oil filters	1
223	The Salvation Army	End-user	New and used clothing; furniture; small appliances; refrigerators	1

No.	Company Name	Business Type	Materials	Reference
224	Sandhill Water Supply and Disposal	Broker; Hauler; Processor	Clear and coloured glass; metal cans; OCC; ONP; PET	1
225	Sanexen Environmental Services Inc.	Processor	PCB contaminated mineral oil; dielectric fluid and PCB contaminated electrical equipment	1
226	Scott's Composting Farm	Processor	Clean sawdust and wood; yard waste; fruit and vegetables; straw; paper; brush; leaves; grass	1
227	Second Harvest	Hauler; Broker	Perishable including packaged, or canned foods for human consumption	1
228	Secural Datashred Inc.	Broker; Consultant; Hauler; Processor	Mixed office paper; ONP; aluminum and steel beverage cans; clear and coloured glass containers; OCC	1
229	Security Document Shredding Inc.	Hauler; Processor	FP; cans; glass; OCC	1
230	Seeley & Arnill Aggregates Ltd.	Processor; Importer/Exporter	Asphalt and concrete	1
231	Shred Express	Processor	FP; kraft; OCC; CPO; magazines; books; glossy paper	1
232	Shred-It Canada Corp. Ltd.	Hauler; Processor	Mixed office paper; OCC; ONP; glass; metals	1
233	Simcoe Plastics Ltd.	Broker; Hauler; Processor; Importer/Exporter	ABS; PC; HDPE; LDPE; LLDPE; MDPE; PS; PP; SAN; PVC; PET; HIPS; acrylic	1
234	Society of St. Vincent de Paul	Hauler; Processor	Clothing; books; small appliances; furniture and household goods	1
235	Soil Recycling Company	Processor	Removes hydrocarbons from soil - landfill cover	2
236	G. Solway and Sons Ltd.	Processor	Ferrous and non-ferrous metals; white goods	1
237	Sterling Recycling Ltd.	Hauler; Processor	HDPE drums; pails and bottles	1
238	Superior Crawford Sand and Gravel	Processor	Inert fill; broken concrete	1
239	Superior Pallet Service Ltd.	Hauler; Processor; Broker; Consultant	Wood pallets; skids; lumber	1
240	Surplus Refrigeration	Processor; Broker; End-user; Consultant; Importer/Exporter; Hauler	Commercial/Industrial refrigeration and air conditioning equipment; tin; aluminum; copper; wood	1

No.	Company Name	Business Type	Materials	Reference
241	Tempest Technologies Inc.	Hauler; Processor; End-user	Computer cartridges, cartridges from laser printers, etc.	1
242	Terra Plastics Recycling Inc.	Processor	HDPE; LPPE; used oil bottles	1
243	Thermofriction Waste Recycling Inc.	Processor; Consultant	Passenger tires	1
244	3R Laser Supply Inc.	Hauler; Processor; Remanufacturer	Laser toner cartridges; cartridge ribbons	1
245	Tonolli Canada Ltd.	Processor	Lead/acid batteries	1
246	The Toronto Harbour Commissioners	End-user; lakefill operator	Clean fill; concrete; clean & mixed rubble; asphalt; brick; shale	1
247	Toronto Salt and Chemicals	Hauler; Processor	Hardwood sawdust	1
248	Toronto Wood Recovery	Processor	Most wood; pallets; particle board; plywood	1
249	Tower/Pak-Man Disposal Services	Hauler; Processor	Asphalt, concrete, clean fill; all drywall; glass food and beverage containers; ferrous and non-ferrous metal; all grades paper; OCC; most wood	1
250	Trevco Ltd. - Covert Inc.	Processor; Hauler	Mixed paper; OCC; magazines; phone books; metal cans; glass bottles; PET; HDPE; LDPE; PVC; PP; PS	1
251	Turtle Island Paper Co.	Broker; Processor; End-User; Hauler	PET; PS; HDPE; pickle pails; plastic drums; organics; skids; FP; glass bottles; aluminum cans; steel cans; OCC; ONP; laser cartridges; paper and paper cups; wood; shrink wrap; stretch wrap; plastic film; polystyrene	1
252	U-Pak Disposals Ltd.	Hauler; Processor	Food waste; all grades of paper; OCC; sawdust; wood; metals; PS	1
253	Universal Drum	Hauler; Processor	Steel and plastic drums	1
254	Waste Recycling Inc.	Processor	OCC; ONP; boxboard; high grades mix; office paper fibres; residential paper fibres	1
255	Wastewise - Georgetown	Community Resource Centre	Collection & sale of household and commercial materials	2
256	Waxman Recycling Industries Ltd.	Hauler; Processor; End-user; Broker; Importer/Exporter	Ferrous metal; non-ferrous metal; white goods; scrap metal	1

No.	Company Name	Business Type	Materials	Reference
257	WCI Wood Conversion Inc.	Processor; Consultant; End-User	All wood	1
258	Wiper Pro Inc.	Hauler; Processor	Clothing; fabric; paper towelling	1
259	Wiseman Brothers	Processor	Used clothing; textile clippings; rags	1
260	Wolfe Iron and Metal Ltd.	Hauler; Processor	Ferrous metal; non-ferrous metal	1
261	Wood Waste Solutions of Canada	Broker; Importer/Exporter; Hauler; Processor	All wood scrap including particle board; sawdust; plywood; pallets	1
262	Woodbridge Pallet Ltd.	Broker; Hauler; Processor	Wood pallets	1

References:

1 Ontario Recycling Resourcebook, Secondary Material Markets Directory, Recycling Council of Ontario, Published by Southam Information and Technology Group, 1993
2 Memo to RIS from MOEE, "Additional Information from WRO", February 15, 1994
3 Information on 3Rs Facilities in the GTA, Table received from, MOEE, June 10, 1993

Notes:

Unless otherwise indicated, all companies listed service the GTA (according to the RCO directory)

GREATER TORONTO AREA
PRIVATE SECTOR RECYCLER'S SURVEY

Company____

Contact Name_____________________________________

Phone #_____________________________ **Date:**_______________________

1. How many accounts does your company provide recycling collection and processing services in the industrial/commercial & institutional (IC&I) sector (i.e. non-residential) in the GTA?

3. Of these, how many are multi-material accounts (i.e. collecting more than one material)?

3. How much material (in tonnes) did your company handle from the GTA in 1993?

4. How many total accounts are projected for 1994?

5. What material does your company usually collect from IC&I accounts (e.g. office paper, cardboard, wood, cans, glass etc.)?

6. Does your company process recyclables (i.e. sort, bale, ship to market) and if so, what materials?

7. Does your company, or parent company, haul waste to landfill/transfer stations?

8. What percentage of your recycling business is in the Greater Toronto Area (Halton, Peel, Metro Toronto, York or Durham)? Is your business concentrated in any particular area?

9. How many employees does your business employ (part and full-time)?

10. Does your company operate a fleet of collection vehicles? If so how many?

11. Have the recently announced Ministry of the Environment requirements for IC&I establishments to conduct waste audits and implement source separation programs affected your business? Do you expect this to change in the future?

12. Has your business been impacted by waste exports?

13. Do you think reduced tipping fees in the GTA will have any impact on your business?

14. Are you experiencing any problems with any of the end markets for materials in which you handling?

Please Return to: **Gordon Day, RIS Ltd – Phone (480-2420) Fax (480-2419)**

Ministry of the Environment and Energy
Ministère de l'Environnement et de l'Énergie
Ontario

FISCAL PLANNING AND INFORMATION MANAGEMENT BRANCH

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May 19, 1993

To whom it may concern:

Please accept this letter of introduction for Resource Integration Systems (RIS) Ltd. which is working on behalf of the Ministry of Environment and Energy on a study of the waste diversion potential and socio-economic impact of the 3Rs within the Greater Toronto Area.

As part of this study we are gathering the most recent information available from various sources. We would appreciate your cooperation in our study and would like to assure you that all information that you will provide will be amalgamated with other data collected in such a manner that proprietary information will be protected.

Should you have any questions, please feel free to contact me at (416) 323-4561.

Yours sincerely,

Orna Salamon

Orna Salamon
Technical Coordinator
3Rs GTA Study

SCHEDULE O-2 — SURVEYS OF IC&I WASTE DIVERSION ACTIVITIES IN GTA IN 1992

General

The purpose of this portion of the study was to collect available information on waste diversion initiatives in the IC&I sector in the GTA. Data on waste generation was allocated to ten major industrial/commercial sectors, as detailed in Chapter 11, therefore industrial/commercial establishments and associations were surveyed according to each of these ten sectors. The ten major sectors were:

1. Primary
2. Manufacturing
3. Construction
4. Transportation/Communication/Utilities
5. Wholesale
6. Retail
7. Finance, Insurance, Real Estate
8. Non-Commercial Services (health care and education)
9. Commercial Services
10. Public Administration (incl. government)

Information was gathered from published articles, documented success stories and previously produced studies. The Study Team carried out telephone surveys in February and March 1993 of IC&I associations representing each industry group, as well as individual generators and staff at each GTA Region.

GTA Regions/Municipalities

Most of the GTA municipalities have been unable to provide accurate figures on quantities of IC&I waste being diverted, for the following reasons:

- the number of IC&I establishments in any given Region or municipality is so large that it is impossible to monitor them all;
- the majority of IC&I waste is collected by a large number of private haulers which has made accurate data collection difficult;
- haulers have not provided municipalities with figures on IC&I waste types or quantities being collected in their Regions;
- a large portion of IC&I waste has been exported to the U.S. since 1991, and accurate figures on amounts are difficult to obtain.

All Regions, with the exception of York, have established extensive programs to assist the IC&I sector with implementation of 3Rs programs and identification of markets for recyclable materials. Literature, posters and videos are provided. Advisors are available to assist companies with waste audits and developing reduction programs. Each Region publishes a directory of recyclers within their region to help IC&I operations identify markets for recyclable materials.

Diversion figures and specific information reported by the individual Regions are presented below.

The Region of Durham

The following 1992 annual waste diversion figures, reported by the Region of Durham, were obtained by doubling reported diverted quantities between Jan. 1 - June 30, 1992:

- fine paper, used beverage containers, and ONP — 581 tonnes (0.2%)
- company reported diversion — 48,306 tonnes (14.9%)

The Region operates a recycling center which reported receiving the following amounts of IC&I waste in 1992:

Fine Paper	228 tonnes	(1.1%)
Cardboard	161 tonnes	(0.8%)
Mixed (paper, glass, metal)	138 tonnes	(0.7%)

The Region also conducted a survey to determine how many companies would require assistance. Nine percent responded and of those companies, 70% indicated an interest in establishing programs (Collis, 1993).

The Region of Halton

The Region of Halton has little information on IC&I waste diversion activities, and the majority of IC&I waste from the Region is presently exported. No figures on exported quantities are available. The Region's MRF accepted 2,684 tonnes of cardboard from the IC&I sector in 1992 (Smith, 1993).

It is estimated that 13,000 - 20,000 tonnes of waste was diverted by the IC&I sectors in the Region of Halton in 1990 (Smith, 1993).

The Region's "Waste Wise" program assists companies with locating markets for recyclable materials and provides advisory services to numerous businesses on developing 3Rs programs. Since its inception in 1990, the program has led to the diversion of 59 tonnes of paper, 40 tonnes of reusable appliances, tools and furniture, 8 tonnes of used clothing and 1 tonne of plastic.

The Region of Peel

The Region of Peel estimated that in 1990, waste diverted from landfill was 118,101 tonnes, or 25% of IC&I waste generated (Morgan-Fraser, 1993). It is estimated 128,855 tonnes were diverted in 1990 (MacLaren Engineers, 1991).

The Region's landfills took in 227,301 tonnes of IC&I waste in 1991 and it is estimated 53,125 tonnes were exported for disposal (Morgan-Fraser, 1993). From programs such as material bans at landfill, the Region's waste exchange, waste assessments, the clean fill referral service and an approximate survey of recyclers and haulers conducted in 1991, the Region estimated that approximately 369,302 tonnes were diverted from landfill in 1991 (Morgan-Fraser, 1993). This represents a 57% waste diversion rate.

The Region expressed concern that estimates for both years are not reliable. Included in these quantities is an estimate of exported waste. In addition, the Region's recyclers could only provide estimates as to the percentage of the material they process that actually comes from within the Region. Finally, many recyclers or haulers contacted did not provide the information requested. At best, the survey is a partial sampling (Morgan-Fraser, 1993).

The Region extensively promotes IC&I diversion. Programs include: a general recycling hotline that also accepts IC&I questions; an annual day-long seminar, including presentations and awards for outstanding achievements in waste reduction (to encourage IC&I waste reduction); publishing a recycling markets directory; liasing with industry associations to promote 3Rs programs; and, providing research and development assistance for companies with new waste reduction initiatives.

One hundred and forty-seven waste audits were performed by Regional staff by 1991, in addition to visits advising companies on the 3Rs. Approximately 10,000 posters were distributed to the IC&I sector to encourage businesses to become environmentally-friendly. While Peel Region advertises its own 3Rs programs, education programs in the schools are conducted with the help of a Joint Committee for the Environment of the Separate and Public Boards of Education of Peel.

Metropolitan Toronto

The estimated Metro Toronto IC&I diversion, excluding public facilities, was 219,543 tonnes for 1990. This amount was not necessarily recycled, however, and could have been exported (MacLaren Engineers, 1991).

Metro Works reported that in 1992, 200,015 tonnes of IC&I waste was landfilled. Metro has also estimated that between 500,000 and 900,000 tonnes have been exported from Metro for disposal (Metro Works Dept., 1993).

1992 waste diversion totals and 1993 projections for Metro offices, as well as general IC&I soil recycling, are presented in Table O-2.1.

Table O-2.1
Metro Toronto Waste Diversion Totals

Waste Diversion Program	1992 Diversion	1993 Projected Diversion
Agencies, Boards, Commissions and Metro Departments	8,300	10,000
Soil Recycling*	56,600	75,000
*Assumed majority of soil originates from IC&I sites		

The City of Toronto Public Works department indicated that:

- in the fall of 1991, material recovery services began in 2,500 restaurants and 6,000 retail stores;
- paper recovered from City operations in 1991 increased by almost 50% over 1990, largely due to extension of program to all city offices;
- developers submitted 83 waste reduction and material recovery plans in 1991, bringing to 168 the number of new plans approved for new developments since 1988. When these properties are in full operation, they will have average diversion rates of 40% and will divert about 22,000 tonnes per year from landfill. This is not diversion of existing quantities of generated waste (City of Toronto, 1992).

City of Toronto Public Works and the Environment Department is responsible for the collection of approximately 75,000 tonnes/year of IC&I waste, and 6,200 tonnes/year of IC&I recyclable materials, principally from institutions, restaurants and small commercial establishments, which is delivered to Metropolitan Toronto facilities. Approximately 3,000 tonnes/year of IC&I fibre is also delivered to a private recycling facility (Vardin, 1994).

Other information on general initiatives undertaken by Metro in the IC&I sector are as follows:

Metro council approved the establishment of depots at selected facilities to receive source separated recycled materials including OCC, glass, cans, plastic, newspapers, telephone books, drywall, leaves, yard waste, tires, scrap metal, wood, and office paper for small companies unable to arrange collection by private recycling companies (MacLaren Engineers, 1991).

Over 300 waste audits were conducted in 1990. Metro Toronto also produced a guide to develop a commercial and industrial waste reduction and recycling plan; a market directory of facilities recycling banned materials; an office paper recycling guide; and an educational kit for schools. Metro also set up an IC&I information hotline which handled 6,000 inquiries in 1991 (MOEE, WRO, 1992). Discussions with Metro have revealed that the hotline is now receiving only 400 calls per month (Garland, 1993).

Table O-2.2 provides a breakdown of IC&I materials recovered in City of Toronto municipal recycling programs:

Table O-2.2
Material Recovery in City of Toronto Recycling Programs
(Confidential Source)

Program	Materials Collected	Quantities (metric tonnes)			
		1988	1989	1990	1991
Commercial (Retail stores, restaurants etc.)	Corrugated Cardboard	141	1,060	1,302	1,855
	Glass bottles and jars (same as res. blue box)	83	679	811	1,598
Fine Paper - City Hall and other city offices	Fine paper (photocopier, laser printer paper, memo paper etc.) Includes newspaper	33	147	378	561

In 1992, 38 tonnes of newspaper and OCC, and 361.3 tonnes of office paper were recovered from City Hall and other City owned buildings (Confidential Source).

Region of York

York Region was unable to report any specific diversion numbers. The Region's charter prohibits Regional government from engaging in private solid waste management.

Surveys of Associations and Generators

This section will summarize information obtained through a telephone survey of a number of industry associations carried out in February and March 1993.

Ontario Waste Management Association (OWMA)

The association conducted a survey of members in the GTA in March, 1991. The number of companies responding was 22. The results indicated that the number of tonnes collected was 186,986 per month and of that total, 33,316 tonnes/month were recycled. That translated into a recycling rate of 17.8% for waste collected. The survey also asked members to estimate collection and recycling numbers for six months from the survey date (September '91). They estimated that tonnes collected and recycled would be 210,077/month and 49,934/month respectively, for a 23.7% recycling rate. The survey did not include information from one large company which operates in the GTA. However, the results are considered a good estimate of activity in 1991.

In an information release in March, 1993, the association indicated that its' members handled 80% of all IC&I waste generated in Ontario. A survey, which was to have been completed in June, 1993, was being conducted to determine recycling levels. The results of this survey will be the best source of data from the association.

Canadian Federation of Independent Business (CFIB)

The association is comprised of independently owned (not publicly traded) companies. It has approximately 4,000 members in Metro Torônto. Total membership for the entire GTA could be as high as 8,000, although no firm figures are known. The federation represents about 10% of independent businesses in Canada. Its membership is broadly based and reflects industry make-up in the economy as a whole. There is some higher concentration in retail and construction. Its members have an average of 12 employees.

Firms with fewer than five employees account for close to 75% of all businesses in Canada. The amount of waste generated by one company with fewer than five employees has been found to be equivalent to that generated by one household. Firms with over fifty employees generate waste equivalent to eighty-seven households, while those with more than 500 employees generate waste equivalent to almost 2,600 households (CFIB, 1990).

In 1991, the federation conducted a survey of its members on environmental issues, (primarily solid waste management practices) and product packaging. The results reflect the views of 2,300 responding members. While recycling was carried out to varying degrees according to industry, the survey found that:

- 70% of businesses in Canada were doing some level of reuse or recycling;
- 79% of Ontario businesses were engaged in 3Rs;
- 1/3 of respondents indicated 3Rs have led to at least a 20% reduction in waste disposal;
- 1/7 of respondents indicated reductions in excess of 50%.

Table O-2.3 shows the percentage of CFIB survey respondents who reported that they composted, reused or recycled materials in 1991.

Table O-2.3
CFIB Survey Respondents Engaged in Waste Diversion Activities in 1991

Industry	%
Agriculture, Forestry, Fishing	100
Mining	83
Manufacturing	89
Construction	79
Transportation	75
Wholesale Trade	78
Retail Trade 63	
Finance, Insurance, Real Estate	33
Services	73
Total	**72**

LURA Group Reports

In February, 1992 the LURA group released a series of reports on the following IC&I sectors:

- Construction and Demolition;
- Retail and Office;
- Manufacturing;
- Education;
- Food & Hotel Services.

The reports were developed as a result of focus groups formed for each sector. The general conclusions reached were that all sectors are now addressing the waste reduction issue and are developing ideas. Most have not yet carried out waste audits or implemented waste reduction action plans at an association level. Initiatives that have been undertaken are at the individual company level.

An exception, however, are the plastics and packaging industries, both of which are actively engaged in reduction and re-use activities as an industry.

Key findings from the reports were:

- Office & Retail

    — some organizations achieved up to 85% reduction in waste going to landfill

- Food & Hotel Services

    — 60% of waste is non organic
    — 40% of waste is organic
    — composting presents an opportunity for significant diversion
    — current composting activity is minimal.

The following sections will summarize available IC&I waste diversion data according to the ten categories used for the study.

Primary Sector

Research to date has not identified information on waste diversion efforts in the primary sector.

Manufacturing Sector

The information presented in this section is divided into activities undertaken by individual waste generators and industry associations.

Information Obtained From Industry Associations

A number of associations were contacted by phone during February and March 1993, as part of this study. The results are summarized below:

Canadian Flexible Packaging Institute

This is a small association, made up of only six members. They were not willing to divulge information, because it may compromise members' trade advantage.

Canadian Manufacturing Association

The association has 2200 members, 70 - 80% of which are located in Ontario. Initiatives are focused more on providing members with information on environmental and waste reduction issues, rather than encouraging or implementing 3Rs programs as an association.

A survey was conducted in 1991 to see how many members had undertaken environmental initiatives. More than half of all respondents indicated that they have corporate environmental policies and action plans in place, up from 45% in the 1990 survey (the exact number of survey respondents was not provided). Over 60% reported that these plans help them reduce waste and increase energy efficiency. Eighty-three percent of respondents reported that they conduct corporate environmental audits of their manufacturing processes and 73% audit their products. Finally, the survey indicated that over a third of respondents have active environmental communication plans focused on employees, shareholders and the public. No figures on waste diversion were requested in the survey.

Canadian Polystyrene Recycling Association

The association operates a plant in the GTA. In 1992 it processed 864 tonnes from the IC&I sector, including 186 tonnes of foam and rigid plastics from food service establishments. (Ulba, CPRA, 1993).

National Apparel Bureau/Dress Guild

No formal industry program exists. Fabric waste is the major waste stream and has been recycled for some time. Therefore, recycling has not led to new waste diversion.

Ontario Furniture Manufacturing Association

The association is down to 85 members. Wood waste, upholstery fabric, leather, foam and plastic wrap are the major waste streams. Members have traditionally recycled or reused these materials and, therefore, no new diversion has been created as a result of these initiatives.

Packaging Association of Canada

Major initiatives are being undertaken. The amount of boxboard used for detergent packaging has been reduced by 40%. It is estimated that it could result in a 30,000 - 40,000 metric tonne reduction in boxboard going to landfill in Canada. The association is conducting a survey of NAPP adherents with Statistics Canada to determine what reduction has been achieved by industry.

Paper and Paperboard Packaging Environmental Council (PPEC)

The Railways Association of Canada has approved a package weight reduction of between 5% and 10% for shipping purposes. This could result in potential savings of 100,000 tonnes nationally of corrugated containers used in shipping.

PPEC formed the Boxboard Task Group with OMMRI to make boxboard more recyclable and to increase end use markets. This is being done in conjunction with a pilot project underway in different Ontario municipalities to collect boxboard in curbside recycling programs.

Society of the Plastic Industry/ Environmental Plastics Institute of Canada (SPI/EPIC)

The association has 450 members nationally, two thirds of which operate in Ontario. It is made up of a variety of plastic-using industries. The association conducted an ad hoc survey of plastic recyclers in 1991 and found the amount recycled to be:

- 1988 - 14,606 tonnes
- 1990 - 31,165 tonnes

No geographical or residential/IC&I breakdown of the information was provided.

The association formed a Strategy Team Plastics (STP) group in 1992. Its purpose is to create an action plan for diversion. The group is comprised of different task groups, including IC&I and Reduce and Reuse groups. The action plan was to have been submitted to the MOEE in late 1993.

Information Obtained From Individual Generators

This information has been obtained from case studies conducted by the Recycling Council of Ontario (RCO), OMMRI, MacLaren Engineers Ltd., SENES Consultants, the Study Team and the Ministry of Environment and Energy. This was supplemented with direct discussions with individual generators. While many of the following individual initiatives were each documented in several of the above sources, the RCO material generally provided the most up-to-date information.

Lever Brothers Discussions with the company revealed that 1991 packaging changes diverted an additional 283 tonnes from landfill over 1990's total diversion. The company has reduced manufacturing waste sent to landfill by 85% since 1991. The following recycling is taking place:

- Pallet recycling - through CPC pallet system;
- Boxboard - pilot programs underway in Markham and Halton;
- Foil, Stretch Wrap, Drums.

General Mills Cereals Group has made plastic liners for boxes 12% thinner. OCC used for transport and boxboard used for cereal boxes are made of 35-40% recycled material (RCO).

William Neilson Ltd's Toronto plant achieved an 83% reduction in waste sent to landfill between 1988 and 1991. Waste was reduced from 1,740 tonnes/yr to 300 tonnes/yr. Corrugated waste was reduced by 90% (RCO, July/Aug. 1991).

Confidential (food company) reduced waste sent to landfill from its Toronto plants in 1991 by 48% over 1990.

Random House Publishing is recycling OCC, paper, books, wood, cans, bottles and plastics. Randam House has reduced waste disposal by over 90%, diverting over 200 tonnes from landfill (RCO).

Hewlett Packard reduced the volume of waste sent to disposal by 80% by August '91 (RCO).

IBM reduced the amount of waste disposed by approximately 70% by the end of 1990 (RCO).

McDonnell Douglas recycled over 40% of its non hazardous waste stream in 1991 (RCO, 1991).

LePages Ltd. achieved 40% reduction in plant waste in 1991, 3% improvement over 1990 (RCO, 1991).

Astra Pharma of Toronto initiated a plastics recovery program for all of the company's consumer plastic wastes. 95% of customers' and outlets' plastic wastes was recovered. In 1991, an estimated 2 tonnes of material was diverted (RCO).

GM Oshawa Autoplex achieved a 36% reduction in waste sent to landfill between 1989 and 1991. It diverted more than 10,000 tonnes of corrugated cardboard in 1991 (MOEE, 1992).

Boeing DeHavilland in Downsview had reduced waste generation by 49% by the end of 1990 (RIS, 1991). In a report released March, 1993, the WRO indicated that DeHavilland diverted 65% of its total waste from landfill. The total amount diverted was 802 tonnes, the majority of which was made up of steel, aluminum, office paper and wood. The estimate of total waste was 1,478 tonnes. The program was started in 1988.

Ashland Chemicals, Mississauga reduced waste through diversion by 99%(RIS, 1991).

Construction and Demolition Sector

Refer to Schedule H - Markets, for a description of construction and demolition waste processing facilities and markets. Quantities of waste diverted have been included where available.

Transportation/Communication/Utilities Sector

Information available on this sector was limited. The information obtained was provided by a few individual generators and was obtained through case studies and direct discussions with Bell Canada staff.

The Toronto Transit Commission (TTC) conducted a trial blue box program in December 1988 to collect newspapers. The report issued by the Commission after the completion of the trial indicated that in the last three weeks of the trial, 4.3 tonnes/week were collected. It was estimated that when the program was fully implemented, a maximum 21.77

tonnes/week or 1,205 tonnes/year of newspapers could be diverted from landfill. This would create a 14% diversion rate. No updated figures have been received (TTC, 1988).

The TTC also offers a plastic recycling program for "Metropasses". Passes can be dropped off at any subway station and are recycled into plastic sewer pipes.

Bell Canada's Zero Waste Program has reduced waste by over 98% in its Fieldway Road office complex which is staffed by over 1,000 employees. Materials recycled include: paper, copper cable, tires, plastics, cardboard and toner cartridges. Waste going to landfill has been reduced from 1,800 lbs/day in 1989 to 25 lbs/day in 1992. The total amount of waste diverted from landfill since the program's inception is 58.5 million lbs. An additional nine Bell facilities of over 10,000 square metres have achieved over 80% reduction. In the GTA, Bell Canada operates 30 facilities with 10,000 employees.

The Bell program emphasizes the 3Rs. For example, paper towels have been replaced by hand dryers and stationery is deposited in a special cabinet for reuse.

Consumer's Gas achieved a 50% reduction of waste from 1989 levels by the end of 1992. Its Waste Management Committee's goal now is to achieve a 75% reduction by 1995 (RIS, 1991).

Municipal wastes included in the Consumer's Gas program are: aluminum cans, batteries, OCC, Boxboard, construction waste (drywall and brick), fine paper, food waste, magazines, newspaper, plastic material (from pipe to foam cups), scrap metal, soft drink containers, wood and yard waste. A waste management manual has been developed to assist staff in all Regions to participate.

Success has been achieved through the emphasis of each of the 3Rs. The company requests that its suppliers reuse skids and remove the blister packaging. Large office supply orders are packaged in boxes and returned to suppliers. Consumer's would now like to develop a zero waste program for its offices.

Pearson Airport is introducing 3Rs programs in Terminals 1 and 2, as well as two service and administrative buildings that Transport Canada controls. Phase 1 was scheduled to be introduced in April or May, 1993 and included fibres such as office paper, newspapers and magazines. Phase 2 includes beverage containers such as bottles, cans and perhaps polystyrene, and was scheduled to be introduced in late summer, 1993. RIS has designed the program and estimates that 610 tonnes per year could be diverted from landfill. This total includes cardboard which is already collected for recycling (RIS, 1991).

The airports flight kitchens are controlled by Cara, Marriot and Steels Aviation. All now recycle cardboard. Cara now has a 34% waste diversion rate. It plans to add steel cans, glass and food waste to the program. Steels Aviation currently recycles these materials with the exception of food waste, and has achieved a 42% diversion rate (WRO, 1993).

Wholesale Sector

Packaging is the major source of waste generated by this sector. A strong emphasis is placed on reduction and reuse. The industry is a major participant in the National Packaging Protocol (NAPP), one of the highest profile waste reduction and reuse initiatives in the commercial sector. Recent published reports have indicated that 55% of industrial packaging waste consists of pallets. While exact figures are not known, the majority of pallets are diverted from landfill (Confidential source). NAPP indicated that it was on course for its 20% reduction goal for the end of '92 (Confidential source).

Retail Sector

Direct discussions were held with a number industry associations. The findings were as follows:

Building Owners and Managers Association

The association has many mall operators as members.

Retail Council of Canada

The council commissioned RIS to do a general assessment of packaging issues and priorities. No survey of the membership was done and it did not focus on recycling. Due to the difficult economic time faced by the retail industry over the last few years, recommendations have not yet been implemented.

Toronto Automobile Dealers Association

The association provides information to dealers regarding new environmental regulations. The dealers then undertake appropriate initiatives with haulers.

Canadian Federation of Independent Grocers

The federation endorses all initiatives being developed by the Grocery Products Manufacturers of Canada. It is not undertaking actions of its own.

Grocery Products Manufacturers of Canada

The GPMC (Grocery Products Manufacturers of Canada) which represents 165 manufacturers and sellers of grocery products, proposed a Packaging Stewardship Model in November 1992. This model is a Canada-wide industry based initiative aimed at taking responsibility for the packaging generated by a number of consumer products. It calls for the creation of an industry funded organization to support municipalities in their recycling efforts and to develop markets for recycled materials. The details of this plan have not been released to date.

Information Obtained on Individual Generators

The following information was obtained from published reports from the RCO, LURA Studies and Waste Reduction Office, and describes efforts by individual retail companies.

Trilea Centres has implemented recycling programs at two of its malls, the Bramalea City Centre and "Shops on Steeles" Mall. The Bramalea City Centre distributed blue boxes to all tenants for the collection of cans, glass and fine paper and the program diverted 23 tonnes in the first eight days. No figures were provided for Shops on Steeles (RCO, Sept., 1992).

The Body Shop is offering a bottle refill program for liquid products. Customers bring empty bottles to be refilled with the same product and will be given a discount. The chain is now looking at the feasibility of switching products from tubes to bottles. It is also collecting other used containers for recycling (RCO, June, 1992).

Sears Canada launched a program to recycle 35 million expired catalogues (LURA Group, 1992).

The Bayview Village Shopping Centre has begun a recycling program with AAA Recycling to collect OCC, fine paper, cans, glass bottles, newspaper, plastic, styrofoam, wood and food waste. No diversion figures have been provided (RCO).

The Dufferin Mall has implemented a Blue Box program collecting standard materials, including food waste, fine paper, polystyrene, clothing, coat hangers, eye glasses and silicone boxes. Its next step will be to target tissue paper, plastic garment bags and boxboard.

The Dufferin Mall generated 520 tonnes waste in 1991-1992. Of this, 83 tonnes were reused or recycled in 1992. A stated waste management goal is to increase the total to 200 tonnes. In 1992, 4,500 lbs of food waste were sent to Scott's Farms for composting (RCO).

Canadian Tire has implemented an extensive 3Rs program. Details were not available at the time of preparing this document (May, 1994).

Finance/Insurance/Real Estate Sector

This group covers many office buildings in the GTA. Pitney-Bowes conducted a survey of its customers in 1992 which showed that 72% of offices in Ontario have recycling programs, compared to only 58% in 1991 and 60% nationally. The survey results are summarized in Table O-2.4.

Table O-2.4
Key Findings of the 1992 Pitney Bowes Survey

ACTIVITY	1991 (%)	1992 (%)
Two-sided photocopying	53	62
Revise Documents on computers	41	46
Buy in bulk	53	55
Recycle soft drink cans	59	72
Recycle cardboard boxes	54	54
Recycle newspapers	56	68
Recycle toner cartridges		
Copier /fax	11	28
Laser printer	18	32

The survey is based on 706 responses from a random sample of 135,000 customers and is considered to be accurate to $\pm$ 6.0%, 19 times out of 20.

Information Obtained about Industry Associations

Information is limited at the association level.

The Toronto Real Estate Board began recycling weekly listing books in September 1991. and recycled 900 tonnes in 1992. It is estimated that 60% of their paper is going back into the recycling process. Nine hundred of approximately 1,400 offices participate. (Henrickson, 1993).

Information on Individual Generators

The Canadian Imperial Bank of Commerce (CIBC), in conjunction with Inter City Papers, initiated a paper recycling program. The bank is now recycling copier and laser printer

paper for reuse. 40,000 lbs. has been collected from CIBC to the end of 1991. It has expanded the program to collect a wider variety of stationery. The program won the RCO 1991 Outstanding Market Development Award (MOEE, WRO, 1993).

Olympia & York (First Canadian Place) has reduced waste sent to landfill by 83%. Paper, food waste, wooden pallets, glass, aluminum and steel containers and construction materials from renovations are recycled. At the end of 1991 the amount of waste sent to landfill was reduced from 40 to 7 tonnes per day through 3Rs programs. The office complex houses 15,000 employees and it is estimated that 30,000 people pass through the mall each day (MOEE, WRO, 1993).

Scotia Plaza has just implemented a recycling program. Diversion rates are not yet known.

Non Commercial Services Sector

This group includes all health care and educational facilities. Each will be discussed separately.

Health Care Sector

Information Obtained on Industry Associations

Information was obtained through telephone conversations and attending the Health Care Environmental Network's March 1993 meeting.

Health Care Environmental Network

The network consists of 125 members, two thirds to three quarters of which are located in the GTA. Membership is made up of:

- Hospitals;
- Nursing Homes;
- Medical offices;
- Ontario Dental Association;
- Canadian Veterinary Association;
- Consultants;
- Haulers;
- Suppliers.

All have implemented 3Rs programs internally. The network assists members by providing information on setting up programs.

Each of the 42 hospitals operating in the GTA is a member. The network was to conduct elaborate surveys in the fall of 1993 concerning existing waste generation and recycling systems.

Circle Consulting (a member) indicated that 40% of nursing homes and 35% of hospitals are recycling food waste. (The reliability of these figures is considered questionable by the Study Team.)

Hospitals with recycling programs have achieved 30-35% reductions in waste sent to landfill.

Ontario Hospital Association

The association indicated that all 42 hospitals in the GTA are recycling. It performed a survey in 1991, but many hospitals did not keep records of quantities diverted from landfill. A new committee has been formed to address environmental issues.

Information on Individual Generators

Sunnybrook Hospital

The hospital has developed one of the most elaborate 3Rs program in the hospital sector. It is currently diverting the following annual tonnages from landfill:

• Diapers	52 tonnes
• Paper	240 tonnes
• Plastic	6 tonnes
• Glass	3 tonnes
• Cans	10 tonnes
• Cardboard	126 tonnes
• **Total**	**437 tonnes**

This represents a 33% overall annual diversion rate.

In addition, the facility has proposed recycling for sanipacks (395 tonnes/yr) and food (156 tonnes/yr). (Martin, Sunnybrook Hospital, 1993)

Toronto East General

This hospital has also developed an elaborate program which has achieved the following results:

- 291.6 tonnes were diverted from landfill in 1992 - a 32% diversion rate;
- 54 tonnes (annual generation) of diapers & incontinence pads are to be added to the program this year (Tulk, 1993).

Mississauga Hospital

The hospital is recycling 43% of its total waste (WRO, 1993).

Ottawa General Hospital

Ortech produced a study of the Ottawa General Hospital in April 1992. It quoted the findings of other studies showing 95% of hospital waste is non-hazardous, non-biomedical solid waste (municipal waste). The audit found 77% of the waste disposed to be made up of food, paper and plastic. The top 5 specific wastes were:

• Food and Food Liquid	(22%)
• OCC and Kraft	(14%)
• Wet Paper and Gauze	(8%)
• Medical Plastic	(8%)
• Fine Paper and CPO	(7.5%)

Ortech concluded that over 50% of the municipal waste component can be reduced, reused or recycled if the major waste types are targeted and large scale composting of food waste can be implemented.

Education Sector

Waste reduction initiatives are being undertaken at many educational facilities. Information collected to date is summarized below.

University of Toronto

The university is implementing an extensive program. It encompasses operations that are part of the main university but does not include affiliated campuses. In the 1991-92 school year, a 14% diversion rate was achieved. The goal for the '92-93 year was 45%, and 51% for '93-94. These increased totals will be achieved by expanding the program and increasing promotion with students (Nower, 1993).

North York Board of Education

The board implemented extensive 3Rs program. (Niven, 1993).

Norway Public School

A program to reduce lunchroom waste has achieved 50% reductions. Numerous school boards are interested in pursuing the program (RCO, April/May, 1992).

Ryerson Polytechnical Institute

The school has implemented the collection of paper, bottles, OCC and cans for recycling (RCO).

Commercial Services Sector

The Canadian Restaurant and Food Services Association/Quick Service Restaurant Council (QSRC)

QSRC includes fast food companies such as MacDonalds, Tim Horton Donuts, Pizza Hut, etc. RIS was commissioned to prepare a national waste minimization study which was completed in May, 1992. Waste audits conducted for the study indicated that:

- total waste generated by QSRC members amounts to 147,000 tonnes, equivalent to 0.5% of waste generated in Canada annually;
- Ontario establishments account for 71,100 tonnes, or 48% of the national QSRC total;
- the largest component of the waste stream consists of food wastes which comprise 39%;
- paper fibre material represents the second largest component at 37% of total;
- plastics comprise 9% of total waste stream;
- take-out meal packaging represents 17% of total solid wastes generated, 88% of which consists of paper fibre packaging in the form of bags, boxboard containers, wraps, napkins and cups. Only 12% of this waste stream consists of plastic packaging.

The survey indicated that while there are waste reduction opportunities from packaging reductions, the greatest opportunity for diversion lies in addressing the organic portion of the waste.

Recent discussions with the QSRC have indicated that no industry initiatives have been undertaken since the study was completed and that, because of the diversity of members, initiatives are more likely to be undertaken on an individual basis in the future. Two such initiatives are individual pilot composting projects initiated by Tim Horton Donuts and MacDonalds (see details below).

Additional information was gathered from other commercial services associations.

Ontario Restaurant Association

There are approximately 4,000 restaurants in the City of Toronto, and 7,000 in all of Metro. The association has about 1300 GTA members which makes up 50% of the total membership. The total includes chains, each chain counting as only one member. Therefore, the actual number of establishments represented by the association is greater than 1300 (Wrigley, 1993).

In 1991, City of Toronto began requiring all restaurants to participate in recycling programs. Materials included were glass, cans, plastics and OCC. The City's restaurants receive municipal pick-up, while in the other municipalities they rely on private haulers.

The association does not collect figures on recycled materials, and will not be undertaking any new initiatives as an industry. Like the QSRC, they indicated that significant diversion cannot take place until wider-scale composting is introduced.

Ontario Hotel and Motel Association

Discussions with the association indicated that no surveys or other initiatives have been undertaken with respect to waste matters (Stefanik, 1993).

Canadian Printing Industries Association

The association has 200 members and represents 10% of the industry in the GTA. Large companies such as Southam and MacLean Hunter make up the membership. The primary component of members' major solid waste stream is fine paper. The association keeps no records as to quantities. Most material is recycled, however, but this is not new diversion (Denholm, 1993).

Numerous other initiatives have been undertaken by individual generators as detailed below.

The Royal York Hotel reduced daily generated waste for disposal from a previous 12.13 tonnes to 5.44 tonnes in 1990, a 49% reduction.

The hotel diverted 66 tonnes of cardboard, 42 tonnes of newspaper, 307 tonnes of glass and 11 tonnes of cans through recycling. It encourages staff to take plastic pails that would otherwise be sent to landfill and has some suppliers collecting food pails for re-use. All food waste is sent to a company producing swill for hogs or to Second Harvest .

MacDonalds The chain has implemented a behind-the-counter program for diversion of food, paper, plastic film and cardboard. Food is sent to pig farmers, paper was going to Scott's Farms, plastic film to Reliable Recycling and cardboard to a variety of handlers. Total waste

diversion is estimated to be between 50 and 60% but has not yet been confirmed (Confidential source).

Tim Horton's has introduced a behind the counter program at thirty of its stores to collect organics, glass and cardboard. The number of stores in the GTA participating in the project is not known (Confidential source).

Pizza Hut is starting the same program as Tim Horton's. Both are being administered by Phillip Environmental. Food waste from both Phillip's projects is sent to Grow Rich for composting (Confidential source).

Kelsey's Restaurants achieved a 65% reduction in waste through reduction and recycling measures (RCO, De., 1990).

Country Style Donuts reduced cardboard in boxes by 25%. The chain is also replacing corrugated cases for juice boxes with a cardboard tray with overwrap and has reduced plastics in polystyrene sandwich and salad containers by 30% (RCO).

The Ramada Renaissance Hotel at the end of 1991 was recycling 50-60% of its wastes (RCO).

The Marriot Eaton Centre Hotel is recycling over 114 tonnes of paper and 1 tonne of plastic per year in its recycling program (RCO).

Westin Hotels at its Harbour Castle facility achieved a 50% reduction in solid waste. This includes a 60% reduction in kitchen wastes. In 1992, the hotel sent 244 tonnes of food waste to farmers and recycled 65 tonnes of glass bottles, 47 tonnes of OCC and 47 tonnes of fine and mixed paper (rooms not included in program). The program encourages reduction and reuse as well as recycling (MOEE, WRO, 1993).

Public Administration Sector.

This sector includes all government offices. The previous discussion on office recycling applies to this sector as well. Most initiatives are undertaken at individual government organization levels.

Ministry of Government Services

This provincial government ministry coordinates the recycling programs for all Government of Ontario offices. It is the largest recycling program in North America, and in the GTA encompasses 200-300 facilities and approximately 45,000 people. Material recycled is comprised of:

- 75% paper;
- 3% cans and bottles;
- 10% wet wastes;
- remainder in polystyrene, wood waste, etc. (Sparling, 1993)

Liquor Control Board of Ontario The LCBO has instituted a large scale recycling program in its offices and stores (Lewin, 1993). Materials included are:

- Paper;
- Newspaper;
- Cardboard;

- Bottles & Cans;
- Polystyrene;
- Other material.

Brewers Retail

This government agency has also implemented a 3Rs program.

Governments Incorporating Procurement Policies to Eliminate Refuse (GIPPER)

This is a large scale multi-government initiative that involves offices and agencies of offices at all three levels of government in Toronto. It was initiated by the Toronto Department of Public Works to coordinate government procurement policies among different offices of different levels of government and promote the 3Rs in general. The committee now includes Metro Toronto, the Toronto Transit Commission, Ontario Hydro, the Ontario Association of School Business Officials, provincial government departments, Supply and Services and Environment Canada.

No figures are kept by the organization as to reduction and recycling among the different members (Pagano, 1993).

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SCHEDULE O-3 — MANDATORY IC&I RECYCLING ORDINANCES

Increasingly, government agencies are recognizing the advantages gained in targeting the IC&I sector to participate in waste minimization programs and activities. Several approaches have been taken in the past to encourage greater waste diversion activity within the IC&I sector. These approaches include: material bans at landfills, tipping fees that reflect the truer costs of waste management, legislation prohibiting unprocessed waste in landfills and mandatory recycling ordinances.

Since the 1990's, more and more government agencies, particularly at the state or provincial level, are enacting mandatory IC&I recycling ordinances coupled with mandatory waste audits and waste reduction planning. This measure ensures that company personnel take direct responsibility for their wastes and become knowledgeable about their waste generating habits. The impetus is provided for companies to further reduce their waste management and diversion costs by implementing source reduction and reuse programs.

Throughout North America, a number of jurisdictions have enacted mandatory recycling ordinances targeting the IC&I sector, including the following:

The State of Rhode Island

The promulgation of regulations for *Reduction and Recycling of Commercial and Non-Municipal Residential Solid Waste* in 1988 permits the state government to require waste audits, waste reduction plans and source separation of recyclable materials from designated IC&I groups (manufacturing/industrial, hotel/restaurant, office, retail/wholesale, health care, college/university, and city/town). The regulations stipulate that the following materials will be recycled: corrugated cardboard, mixed office paper, newsprint, wood waste, aluminum, glass food and beverage containers, steel and tinned steel containers, PET and HDPE containers, used lubricating oil, vehicle batteries, white goods, automobiles, telephone directories, laser toner cartridges, coated unbleached kraft beverage carriers, and leaf and yard waste. The implementation dates are staggered according to the size of the company (Brown University Centre for Environmental Studies, 1992).

Personal communications with John Callan at DEM (1993) suggest that, in fact, the program has prompted companies to look beyond the mandatory materials and develop more comprehensive waste reduction programs. John cautions that much of the additional activity has been highly dependent on available markets for the materials. As markets become saturated with materials and prices plummet, John feels that companies will stop recycling those materials.

The Province of Ontario

Borrowing from Rhode Island's legislation, the Province of Ontario recently promulgated the *3Rs Regulations* in March 1994 requiring specific IC&I groups (retail shopping, construction and demolition, offices, food services, hotels and motels, hospitals, schools, and manufacturing) to conduct waste audits, develop waste reduction plans, and source separate designated materials from the waste stream. The list of recyclable materials is not as exhaustive as the list prepared by the State of Rhode Island; however, Ontario's list reflects the rapid level of change occurring in the recycling industry. Apart from the commonly targeted materials (corrugated cardboard, fine paper, aluminum and steel beverage containers, newsprint, glass containers, PET containers, wood, steel, brick and cement concrete, and drywall), the Ontario Government also included materials (polystyrene expanded foam, polystyrene trays, reels and spools, polyethylene -linear low density and low density- film, and polyethylene -high density- jugs, pails, crates, totes, and drums) for which

recycling markets only recently have become securely established (The Ontario Gazette, 1994).

The State of New Jersey

New Jersey Law 1987-102, titled *Mandatory Source Separation and Recycling Act*, requires all citizens of the state to participate in recycling programs for designated recyclable materials (State of New Jersey, 1987). The onus has been placed on the individual counties and municipalities to implement the law at the local level and to oversee the implementation of the source separation programs by the IC&I sector. In support of the recycling ordinance, the State of New Jersey has also enacted legislation requiring provision for separation, collection, and storage of recyclables in proposed commercial developments utilizing 1,000 square feet or more of land (Sarafides, 1993).

The State of Maine

As part of its *Solid Waste Disposal Laws (1989),* the State of Maine requires all businesses, state government offices, and universities within the State to source separate, at a minimum, office paper (ledger, computer and bond paper) and corrugated cardboard (OCC). Unlike other jurisdictions, the State of Maine has targeted businesses as small as 15 employees to participate in the recycling ordinance. The State Government estimates that office paper and OCC contributes 38% to the total waste stream. Under the legislation, any person subject to the source separation requirements may use the office paper or OCC as fuel for the generation of heat, steam or electricity if no secure recycling market is available (State of Maine, 1989; Breggs, 1993).

New York State

Local governments, such as New York City and Oswego County in New York State, have begun to introduce legislation requiring local businesses to source separate materials for recycling purposes. New York City's *Local Law 19* mandates that commercial establishments recycle high grade office paper, corrugated cardboard, metal products, construction waste, newspapers, magazines, catalogues, glass containers, plastic containers, and plastic film (Cacandes, 1993). For the most part, Oswego County's legislation requires that businesses recycle similar materials (Lichenstein, 1993).

Pennsylvania State

A comprehensive regulatory package for residual waste was put in place in Pennsylvania in July 1992. Much of the package is devoted to strictly regulating and monitoring residual waste disposal and processing facilities. The most striking provision in the regulation is the requirement that all industries generating a metric ton or more of waste per month must develop a source reduction strategy. Industries are required to examine their waste streams, including the hazardous portion, and set an overall source reduction goal. They must also describe what source reduction programs have already been put in place and describe what programs they will put in place to reach their goals, and track reduction estimates. There are no state imposed goals to be met (Glenn, 1993).

Although the source reduction strategy does not need to be approved by the Department of Environmental Resources (DER), there are several checks along the way. First, all targeted industries were required to have a strategy fully in place by July 1993. After that date, industries were required to have the strategy on file at the plant, and available for inspection. Additionally, permits for the processing or disposal of an industry's residual waste will not be issued without a DER review of the plan.

Monmouth County, New Jersey

Monmouth County implemented a mandatory recycling program which includes the residential, commercial, and construction and demolition debris streams. Penalties are in place, and an enforcement team is available to discourage the disposal of recyclables at the landfill. Mandatory separation of recyclables for the commercial sector began in 1988 and includes newspaper, glass containers, aluminum cans, high-grade paper and corrugated paper. Mandatory materials for the demolition sector include asphalt, concrete, and certain wood wastes (pallets, clean lumber, stumps).

Dane County, Wisconsin

In 1991, Dane County banned recyclables from its landfill and implemented mandatory curbside and drop-off recycling programs. The Public Works Department commissioned a study to find out whether or not the mandatory recycling programs were effective. Waste composition analysis for both the residential and commercial sectors were conducted before and after the implementation of the mandatory recycling ordinance.

The results of the before and after composition analysis found a drop in the proportion of materials included in the landfill ban. The most dramatic drop was in the fibre stream -- the waste composition for corrugated cardboard in the commercial sector dropped from 20.5% to 4.3%. Recycling collectors and processors reported receiving almost 24% more material since the landfill bans and mandatory recycling programs (Collins, 1992).

Other

Throughout Canada, provincial governments have written legislation (such as British Columbia) or are in the process of developing legislation (such as Saskatchewan and Quebec) enabling them to introduce regulations, at a future date, that will mandate waste audits, waste reduction plans, or mandatory source separation programs. Prince Edward Island has enacted legislation that will prohibit any unprocessed waste from entering landfills within the province. This legislation has the effect of requiring the IC&I sector to recycle materials on-site through source separation programs or off-site through mixed waste processing operations.

Impacts of Mandatory Recycling Ordinances

To date, there has been very little information published on the success of IC&I recycling ordinances. A study, completed in 1992 by Brown University Centre for Environmental Studies (1992), evaluated the effect of the mandatory commercial recycling program on targeted companies in Rhode Island. Of those companies participating in the study (448 in total), an overall diversion rate of 34% was achieved through the implementation of recycling programs. Furthermore, once the participating companies began collecting information about their waste generating habits and began initiating source separation programs, there was greater incentive to introduce source reduction activities, including double-sided photocopying, reuse of shipping/packaging materials, and substitution of reusable items for disposable ones. In addition, 74% of the companies also reported to have accrued savings in avoided landfill costs while 37% reported to have generated revenue from the sales of recyclable materials.

Similar results have been reported by Oswego County, which attributes 75% of its 50% waste diversion figures to the mandatory IC&I recycling ordinance (the waste diversion figures also take into consideration the effects of the recession and waste exports) (Lichenstein, 1993).

Not all jurisdictions report successful implementation of the recycling ordinances. For example, New Jersey communities report a reluctance of the waste hauling industry to collect and process recyclables because it reduces revenues collected from hauling waste. Furthermore, the overwhelming supply of recyclable materials in the market has been accompanied by a drop in the quality of recyclables collected from businesses. Market forces are expected to correct this problem in the near future (Duncan, 1990).

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SCHEDULE O-4 — CONTACTS MADE FOR ESTIMATION OF COVERAGE OF 3RS REGULATIONS

Contacts Made to Refine Estimates of 3Rs Capture

As a first step in acquiring data to assess the number of establishments which would be affected by the proposed 3Rs Regulations, the Study Team contacted the three IWA consultants (C.N. Watson and Associates, Keir Consulting, MM Dillon) for socio-economic information that may have been used in the IWA landfill studies and which might be relevant to this assessment. These sources focused on specific geographic areas around the proposed landfill sites, and therefore were not of value to this study.

Subsequently, the sources listed below were consulted to gather background data on the likely number of generators in each major category in the GTA who would be subject to the Ontario 3Rs Regulations. The available sources did not provide data at a level of detail which would have been of value to the GTA 3Rs analysis.

List of Information Acquired for Assessment of the Impact of the 3Rs Regulations:

- Estimates of affected IC&I Establishments in Ontario affected by the 3Rs Regulations, MOEE, Ontario IC&I Waste Reduction Manual, 1992
- Summary of Building permits issued by year and municipality from 1981 through 1992
- List of Group A, B and F hospitals as defined under Ontario Regulation 964, taken from Ministry of Environment and Energy, 1994. A Guide to Waste Audits and Reduction Workplans for Industrial, Commercial and Institutional Sectors, 1994
- Data on hospital facilities (# beds reported for non-teaching facilities but not for teaching and specialty facilities), Health Reports Supplement, #5, 1991, v3, #2, Hospital Statistics: Preliminary Annual Report, 1989/90
- Data on Schools (aggregate Ontario) - type and enrollment, Education in Canada, 1989/90
- List of post-secondary institutions in GTA
- Private Schools in Ontario, Ontario Ministry of Education and Training, Apr. 1993
- List of private schools with enrollment greater than 300 students, supplied by Paul Raymond, Ontario Ministry of Education
- Directory of Education, 1991/92, Ontario Ministry of Education
- Summary of office buildings - 4 size ranges; # employees averaged over each range, Metro Toronto Planning Department
- Summary of shopping centres in GTA 1983,86,90 - 5 size ranges, Metro Toronto Planning Department
- Employment Profiles - # establishments in 7 size ranges, over 6 sectors (further breakdown by sector for manufacturing sector), 1992, Metro Toronto Planning Department
- Employment Profile for Metropolitan Toronto, 1983 - 1986, Metro Toronto Planning Department
- Employment in 6 size ranges by 2-digit SIC for Metro Toronto, Statistics Canada, Business Register, 1992
- Business Establishments by 9 employment size ranges and SIC, Metro Toronto, 1991, Board of Trade for Metro Toronto, Metro Toronto Business and Market Guide, 1993
- Catalogue of Accommodations in Ontario (data on # units), Ontario Ministry of Culture, Tourism and Recreation, 1993

List of Contacts Made:

Background data for all regulations :

- Ontario. Ministry of the Environment. Waste Reduction Office. Contact : Adam Ciulini, 314-4633.

Retail shopping establishments :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.

Retail shopping complexes :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.

Large construction projects :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.
- Statistics Canada. Building permits : annual summary (64-203).

Large demolition projects :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.

Office buildings :

- Municipality of Metropolitan Toronto. Planning Department. Contact: Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.

- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.

Restaurants :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
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- Statistics Canada. Business Register. Unpublished data. Contact : Louise Bard, Acting External Liaison and Data Dissemination Officer, (613) 951-9021.

Hotels and motels :

- Hotel Association of Metropolitan Toronto. 629-7770.
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Hospitals :

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- Canadian Almanac & Directory 1993.
- Ontario. Ministry of Education. Central Ontario Region. Contact : Paul Raymond, Superintendent of Education, 491-2258.
- Ontario. Ministry of Education. Directory of Education.
- Ontario. Ministry of Education. Information Services. Contact : Simon Loban, Supervisor — Reference Services, 325-2652.
- Ontario. Ministry of Education. Statistical Services. Contact : Annie Lan, Statistical Information Officer, 325-2693.
- Statistics Canada. Education statistics bulletin (81-002).

Multi-family dwellings :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.
- Statistics Canada. Profile of census divisions and subdivisions in Ontario — part A. 1991 Census. (95-337)

Large manufacturing establishments :

- Municipality of Metropolitan Toronto. Planning Department. Contact : Wayne Morgan, 392-8130, Ron McCallum, 392-8766.
- Region of Durham. Planning Department. Contact : Rhoda Brand-Stewart, (416) 728-7731.
- Region of Halton. Planning Department. Contact : Keith Barker, 825-7213.
- Region of Peel. Planning Department. Contact : Paul Mountford, 791-9400.
- Region of York, Planning Department. Contact : Paul Bottomley, 362-2464.
- Statistics Canada. Business Register. Unpublished data. Contact : Louise Bard, Acting External Liaison and Data Dissemination Officer, (613) 951-9021.

Importers :

- Statistics Canada. Canadian imports by domestic and foreign-controlled enterprises (67-509).
- Statistics Canada. Imports by commodity (65-007).
- Statistics Canada. Imports, merchandise trade (65-203).

SCHEDULE O-5 — FLOW CONTROL

Flow control legislation is a method by which government agencies can gain greater control over waste collection, processing and disposal activities within their jurisdiction. Flow control permits a government to direct the movement of waste within its borders by either prohibiting the movement of waste beyond its borders or stipulating specific locations for processing and disposal of waste and recyclables. Under flow control, a government entity is given the authority to direct all solid waste brought or produced within its borders to a specific facility. In some cases, a flow control ordinance has required waste haulers to dispose of waste at a certain site, in other cases the ordinance has prohibited private companies or individuals from being able to remove materials from the solid waste stream for economic purposes such as reuse or recycling (Cofield, 1991).

Flow control can give a municipality power and flexibility in setting rates, fees and charges for services provided by or on behalf of the facility and, therefore, provides governments with greater control over their disposal costs. For example, in the United States, flow control has been used by local governments to ensure that energy-from-waste facilities, which often establish "put-or-pay" contract with the local government, receive the mandatory feedstock, thus ensuring that the local government avoids having to pay financial compensation to the facility owners.

The origins of flow control are found in the United States in the 1970s, when governments started building or sponsoring the construction of large-scale resource recovery and energy-from-waste facilities. In most instances, the financing of these projects was dependent on a financial arrangement featuring the sale of bonds, backed by a combination of the anticipated revenues, including income generated from tipping fees and the sale of electricity or steam. This strategy depends on a guaranteed source of waste. Often the contractor and the government enter into a contract arrangement to ensure that the government provides a minimum daily quantity of waste delivered to the facility's door or pays compensation to cover the loss in tipping fees.

Governments needed assurance that they would be able to fulfill the contractual agreement with guaranteed quantities of waste going to the facility. Flow control helped to ensure that a sufficient volume of waste was brought to the facility. Today, in fact, the adoption of a flow control ordinance has become a common precondition to the letting of the construction bonds. Flow control provides assurances to the investment community that the revenue generated from the sales of waste to the facility will be sufficient to provide bond coverage (New York Legislative Commission, 1985).

Unfortunately, in the past, one of the casualties of flow control legislation working in conjunction with energy-from-waste facilities is that the flow control ordinances have prohibited the separation and diversion of recyclable components of the waste stream, particularly wastes with high BTU values, such as paper and paper products and plastics. Several local governments in the United States have watched recycling programs falter once flow control ordinances and supporting legislation have been enacted to ensure a constant flow of waste to energy-from-waste facilities.

The need for flow control has not been limited to energy-from-waste and resource recovery projects. In the 1980s and 1990s municipal government have moved in the direction of an integrated municipal waste management systems approach featuring materials recovery facilities, mixed waste processing facilities, and composting facilities. In many instances, these types of waste diversion facilities have been constructed in conjunction with flow control ordinances to ensure that the components of the waste stream or the entire waste stream, in the case of mixed waste processing facilities, is processed through these facilities

before being disposed. This approach also has helped to extend the life of local landfill sites by reducing the amount of waste entering the landfill as a result of front-end waste diversion activities. To the same end, flow control legislation has been enacted to prohibit or restrict the import of out-of-state wastes for the purpose of protecting in-state landfill capacity.

Flow control ordinances introduced by states, counties and municipalities in the U.S. have come under legal challenges by commercial haulers as being unconstitutional and in violation of the Commerce Clause. During numerous challenges, the prosecution has argued that flow control ordinances interfere with interstate commerce thereby disrupting and prohibiting business and commerce (Greenhouse, 1994). This form of interference is considered unconstitutional and has been argued as such. Over the past decade, legal challenges have taken place in Delaware, Rhode Island, New Jersey, Maine, Michigan, Minnesota, Iowa, Indiana, Alabama, South Carolina, Ohio and California. Court challenges targeting state imports bans that restrict the disposal of out-of-state waste at in-state private landfills have consistently been struck down by courts as violating the constitutional principle that Congress, not the states, has the power to regulate interstate commerce (Peterson, 1993).

Despite these challenges, in the U.S., twenty-seven states have passed laws that authorize their local governments to adopt flow control policies. Furthermore, many of the challenges targeting municipal flow control ordinances that have been taken to court have come out in favour of the defence. Municipal flow control export bans imposed to support a local waste disposal or processing facility, generally, have been judicially upheld over many years (Darcy, 1993).

Some exceptions exist, as in the case of Minnesota. In 1987, the Minnesota Metropolitan Council enacted legislation to prohibit the landfill disposal of unprocessed waste by 1990. This was amended to January 1, 1993 to coincide with the development schedules for processing facilities and recycling programs (Metropolitan Council, 1990). After January 1993, landfilling of recyclables, rejects or residual wastes would require certification from the county that the material could not be processed. State-wide the legislation required that, by 1992, counties outside of the Metropolitan area would be prohibited from disposing unprocessed waste in unlined landfills. After 1995 the prohibition would be extended so that unprocessed waste could not be disposed in any landfill in the state without certification. This legislation was challenged. The February 1993 decision by the Eight Circuit Court of Appeals in Minneapolis held that Minnesota counties may not "designate" where haulers take mixed garbage. As a result of the decision, none of the Minnesota counties enforce their waste designation ordinances now because they fear lawsuits (State Recycling Laws Update Year-End, 1994).

In a recent Supreme Court ruling on a case from Rockland County, N.Y., a previous judicial ruling that had upheld a Town's ban on flow control law was struck down in a majority decision. This new decision is viewed as a potential threat to flow control in the U.S. and raises the possibility of congressional legislation to deal with the issue at a federal level.

Due to the uncertainty over the constitutionality of flow control statutes, state, regional and local governments are becoming increasingly cautious about enacting further flow control ordinances. This uncertainty has also delayed or in some cases cancelled the development of waste processing facilities due to the risk involved in providing municipal bonds (Ewel, 1993). There is increasing pressure by states and municipalities for Congress to resolve the issue.

Canadian jurisdictions, for the most part, have not faced the same trials and tribulations associated with flow control legislation as being faced by U.S. jurisdictions. Several reasons exist. For one, not many Canadian jurisdictions have enacted flow control legislation. The

primary reason is that most municipal governments have assumed the responsibility for collecting their own wastes and, therefore, can ensure that the wastes and recyclables are directed to the appropriate processing or disposal facilities. Furthermore, Canadians have tended to favour other forms of financing, other than bond arrangements, to fund the construction and operation of processing facilities. Consequently, there has been less of a tendency for Canadian jurisdictions to enter into a "put-or-pay" agreement with contractors. Many local governments within Canada own their processing facilities and either contract the operations to the private sector or operate the facility themselves.

However, the issue may become subject to public debate in Canada. The Ontario Waste Management Association (OWMA) has voiced its opposition to flow control, on the basis that is appears to artifically benefit publicly owned facilities (for waste management) at the expense of private facilities, thus stifling competition. The concern is that if governments gain the opportunity to mandate mechanisms for collection, disposal and recycling of material from the IC&I waste stream, IC&I customers will lose their ability to benefit from market competition and to chose the haulers and systems that best suit their waste management needs (Taylor, 1994).

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